MANUAL OF INSTRUCTION

INTERNATIONAL BUSINESS MACHINES CORPORATION

Lessons + Tests Illustrated (1936) (as is) 45.-

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

EXAMINATION

ELECTRIC ACCOUNTING MACHINES

DIRECTIONS

Space has been provided for filling in answers to all of the questions. Where true and false statements are used, a line precedes the statement, on which a zero is to be placed if the statement is false, and a plus sign (+) if the statement is true. In other questions you are asked to fill in certain information.

READ EACH QUESTION CAREFULLY AND MAKE CERTAIN WHAT YOU ARE TO DO BEFORE ANSWERING IT.

_____
Name

_____
Number

_____
GRADE

Name

Number

Grade

Give the type numbers of the following machines:

1. Vertical Tabulator. Type 91

2. Standard 3 Counter Tabulator. Type 90

3. Standard 5 Counter Tabulator. Type 92

4. Automatic Control Tabulator. Type 93

5. Electric Accounting Machine (printing tabulator, 5 counters, 7 print banks, direct subtraction). Type 285

6. Electric Accounting Machine (printing tabulator, 7 counters, 7 print banks, direct subtraction). Type 297

7. Electric Accounting Machine (printing tabulator, 7 counters, 7 print banks, adding only). Type 302

8. Alphabetic Accounting Machine. Type 405

9. 0 The standard 5 counter tabulator has two sets of brushes.

10. + When the information punched in every card is printed on the report- that is, when there is a printing cycle for every card cycle, the machine is "listing."

11. 0 The type 285 Electric Accounting Machine can be obtained with the following listing and tabulating speeds:

    75 list, 75 tabulate
    75 list, 150 tabulate
    120 list, 120 tabulate
    120 list, 150 tabulate
    150 list, 150 tabulate

12. + The standard counter on the Vertical Tabulator has 8 adding and 1 accumulating positions.

13. + The Alphabetic Accounting Machine is made in two sizes, the 56 counter and the 80 counter.

14. 0 The Type 285 Electric Accounting Machine is basically wired for 5 print banks; one for each of the 5 counters.

15. + The Alphabetic Accounting Machines are all equipped with 43 alphabetic-numerical type bars and 45 numerical type bars.

16. 0 The automatic plugboard is standard on the following machines:

    Automatic Control Tabulator
    Electric Accounting Machines, Types 285, 297, and 302
    Alphabetic Accounting Machine

17. + The Vertical Tabulator and Standard Tabulator are not equipped with the automatic control feature. These machines control by means of stop cards.

18. + Automatic control implies control by comparison of the punched holes in the card passing through the lower brushes with those passing through the upper brushes.

Give the type numbers of the following machines:

1. Vertical Tabulator. Type _____

2. Standard 5 Counter Tabulator. Type _____

3. Standard 5 Counter Tabulator. Type _____

4. Automatic Control Tabulator. Type _____

5. Electric Accounting Machine (printing tabulator, 5 counters, 7 print banks, direct subtraction). Type _____

6. Electric Accounting Machine (printing tabulator, 7 counters, 7 print banks, direct subtraction). Type _____

7. Electric Accounting Machine (printing tabulator, 7 counters, 7 print banks, adding only). Type _____

8. Alphabetic Accounting Machine. Type _____

9. _____ The standard 5 counter tabulator has two sets of brushes.

10. _____ When the information punched in every card is printed on the report- that is, when there is a printing cycle for every card cycle, the machine is "listing."

11. _____ The type 285 Electric Accounting Machine can be obtained with the following listing and tabulating speeds:
75 list, 75 tabulate
75 list, 150 tabulate
120 list, 120 tabulate
120 list, 150 tabulate
150 list, 150 tabulate

12. _____ The standard counter on the Vertical Tabulator has 8 adding and 1 accumulating positions.

13. _____ The Alphabetic Accounting Machine is made in two sizes, the 56 counter and the 80 counter.

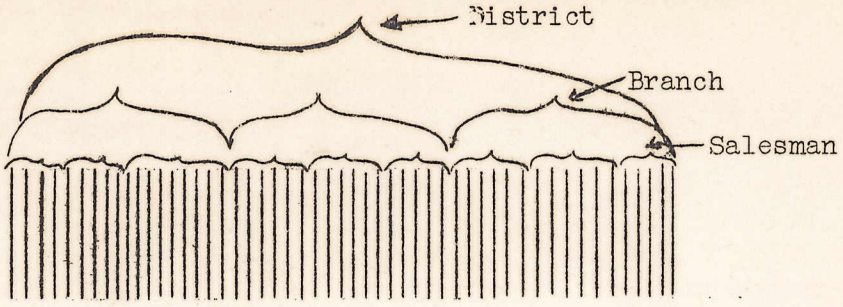
14. _____ The Type 285 Electric Accounting Machine is basically wired for 5 print banks; one for each of the 5 counters.

15. _____ The Alphabetic Accounting Machines are all equipped with 45 alpha-betic-numerical type bars and 45 numerical type bars.

16. _____ The automatic plugboard is standard on the following machines:
Automatic Control Tabulator
Electric Accounting Machines, Types 285, 297, and 502
Alphabetic Accounting Machine

17. _____ The Vertical Tabulator and Standard Tabulator are not equipped with the automatic control feature. These machines control by means of stop cards.

18. _____ Automatic control implies control by comparison of the punched holes in the card passing through the lower brushes with those passing through the upper brushes.



19. The Salesman Total Counter Dial Switch should be set to Minor.

20. The Branch Total Counter Dial Switch should be set to Intermediate.

21. The District Total Counter Dial Switch should be set to Major.

22. + Group Indication is the addition of only the first card of a group. Adding is the addition of the amounts punched in the cards of the group for a total of the group.

23. Cross out those fields which would not normally be group indicated:

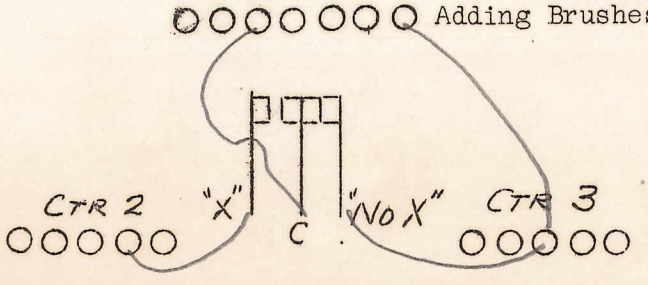
~~Hours~~
Commodity
Man No.
~~Amount~~
Branch Office
Job No.
~~Pieces~~
~~Salesman's Commission~~

24. 0 "Manual Reset" means manually clearing the counters by turning the reset shaft by hand.

25. + The printing of the asterisk (*) indicates the figure printed is a total and not a listed figure.

26. + The class selector makes it possible::
(1) to select the counter in which information is to appear
(2) to select one or two amounts appearing on a card
(3) to eliminate certain classes of information

27.



The class selector is in its normal (de-energized) position. Connect the points of this class selector relay contact so that column 15 will add in counter #2 on "X" punched cards and in counter #3 on "No X" cards.

19. The Salesman Total Counter Dial Switch should be set to _____.

20. The Branch Total Counter Dial Switch should be set to _____.

21. The District Total Counter Dial Switch should be set to _____.

22. _____ Group Indication is the addition of only the first card of a group. Adding is the addition of the amounts punched in the cards of the group for a total of the group.

23. Cross cut these fields which would not normally be group indicated:

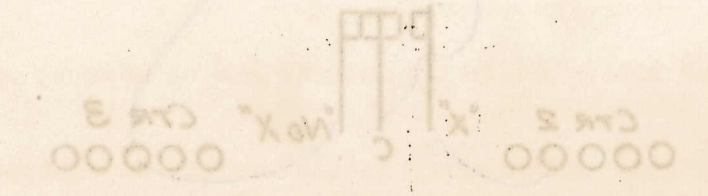
Hours
Commodity
Man No.
Amount
Branch Office
Job No.
Piece
Salesman's Commission

24. _____ "Manual Reset" means manually clearing the counters by turning the reset shaft by hand.

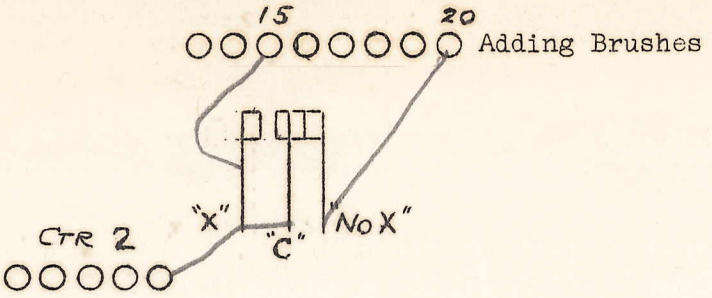
25. _____ The printing of the asterisk (*) indicates the figure printed is a total and not a listed figure.

26. _____ The class selector makes it possible:
(1) to select the counter in which information is to appear
(2) to eliminate certain classes of information

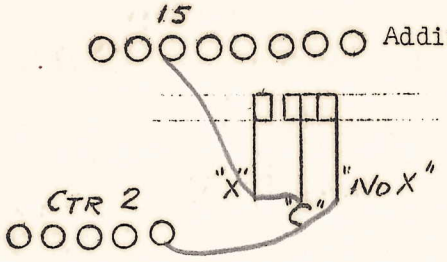
27. ○○○○○○○ Adding Brushes



The class selector is in its normal (de-energized) position. Connect the points of this class selector relay contact so that column 15 will add in counter #2 on "X" punched cards and in counter #3 on "No X" cards.

28. 

The class selector is in its normal (de-energized) position. Connect the points of this class selector relay contact so that column 15 will add in Counter #2 on "X" punched cards and column 20 will add on "No X" cards.

29. 

The class selector is in its normal (de-energized) position. Connect the points of this class selector relay contact so that column 15 will be added into counter #2 on "No X" cards and will be eliminated on "X" cards.

30. __+__ The function of the X-distributor is to provide "X" impulses to control the subtraction counters for either adding or subtracting.

31. __+__ If an Electric Accounting Machine is equipped with direct subtraction counters, the figure (not the complement) and the counters are impulsed from the X-distributor to subtract the card.

32. Find the complement of the following figures. Show your calculations.

186
19465

999
186
813
1
814

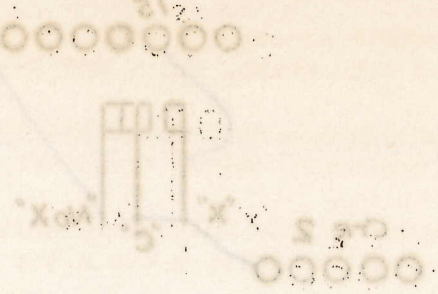
99999
19465
80534
1
80535

33. __0__ The Electric Accounting Machine Type 285 can be made to operate on either 110 or 220 AC or DC.

34. __+__ The Alphabetic Accounting Machine can be made to operate on either 110 or 220 AC or DC.

35. __0__ The Vertical and Standard Tabulators may be equipped with a Summary Punch.

36. __0__ Only the Electric Accounting Machines Types 285, 297, 302, and the Alphabetic Accounting Machine are equipped with a card count hub.



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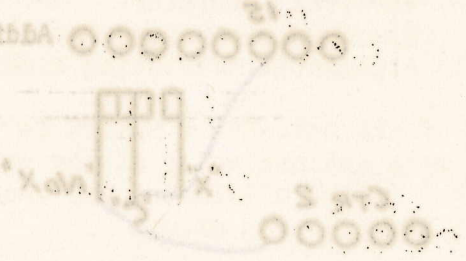

The class selector is in its normal (de-energized) position. Connect the points of this class selector relay contact so that column 15 will be added into counter #2 on "No X" cards and will be eliminated on "X" cards.

30. _____ The function of the X-distributor is to provide "X" impulses to control the subtraction counters for either adding or subtracting.

31. _____ If an Electric Accounting Machine is equipped with direct subtraction counters, the figure (not the complement) and the counters are impulsed from the X-distributor to subtract the card.

32. Find the complement of the following Figures. Show your calculations.

1865
1965

33. _____ The Electric Accounting Machine Type 285 can be made to operate on either 110 or 220 AC or DC.

34. _____ The Alphabetic Accounting Machine can be made to operate on either 110 or 220 AC or DC.

35. _____ The Vertical and Standard Tabulators may be equipped with a Summary Punch.

36. _____ Only the Electric Accounting Machines Types 285, 297, 502, and the Alphabetic Accounting Machine are equipped with a card count brush.

37. + The Electric Accounting Machines Types 285, 297, and 302, are equipped with Start, Stop, and Reset Keys.

38. 0 The Electric Accounting Machine Type 285 will not start if the start key is depressed unless there are cards in the machine.

39. + The purpose of the Auto-Start Switch is to make possible to automatic starting of the drive motor after the counters have been reset to zero.

40. 0 Additional cards may be added in the feed hopper while the machine is running on the following machines:
Vertical Tabulator
Electric Accounting Machine Type 285
Alphabetic Accounting Machine

41. + The purpose of the Auto-Reset Switch is to clear the counters and print the totals automatically at the end of a group. In other words, the Auto-Reset Switch eliminates the necessity of depressing the Reset Key at the end of a group.

42. + On all machines equipped with the accumulating collar, the counter will clear at each control change if the collar is engaged.

43. 0 The control brushes may be used for adding on the Electric Accounting Machine, Type 285.

44. + When plugging the control unit on the Type 285 machine the minor shunt plug is plugged (in the row provided for it) directly under the last position to the left being minor controlled.

45. 0 Looking at the plugboard, the control unit on the Type 285 machine is always wired from left to right.

46. 0 An unpunched column in the control field will act in the control unit of the Type 285 machine the same as a zero.

47. + To count the number of cards going through the feed it is necessary only to wire the card count hub to a counter plughub.

48. 0 It is possible to clear only a part of the split counter on a Vertical Tabulator on the reset.

49. 0 The impulse to operate a Class Selector unit is obtained from the X-position in the card. This impulse is picked up by the adding brushes.

50. If the machine does not start when the start key is depressed, check the following (Cross out any items it is not necessary to check)"

1. Wall Plug
2. ~~Cards in the machine~~
3. ~~Main Line Switch~~
4. Plugboard Wiring
5. Main Line Fuses
6. Pointer on Timing Index Wheel
7. ~~Position of Counter Dial Switches~~

37. _____ The Electric Accounting Machines Types 285, 297, and 302, are equipped with Start, Stop, and Reset Keys.

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42. _____ On all machines equipped with the accumulating collar, the counter will clear at each control change if the collar is engaged.

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2. Cards in the machine
3. Main Line Switch
4. Plugboard Wiring
5. Main Line Fuses
6. Pointer on Timing Index Wheel
7. Position of Counter Dial Switches

MECHANICS OF ELECTRIC ACCOUNTING MACHINES

Place a check mark in the space provided for it if the machine has adding or control brushes or both:

		Adding Brushes	Control Brushes
1.	Vertical Tabulator - - - - - - - - - - - - - -	✓	None
2.	Standard Tabulator - - - - - - - - - - - - - -	✓	None
3.	Automatic Control Tabulator - - - - - - - -	✓	✓
4.	Electric Accounting Machine Type 285 - - -	✓	✓
5.	Electric Accounting Machine Type 297 - - -	✓	✓
6.	Electric Accounting Machine Type 302 - - -	✓	✓
7.	Alphabetic Accounting Machine - - - - - - - -	✓	✓

8. 0 The chief advantage of the automatic plugboard is its compactness.

9. + Each brush is connected to a wire which carries the electrical impulse from the adding brush to the adding brush hubs on the plugboard.

10. + The carry-over position is the last position to the left in a counter which is used for accumulation of the carry-over from the counter wheel to its right. It is not operated by a magnet and consequently cannot be used for the addition of digits greater than one.

11. 0 On the Type 285 Electric Accounting Machine the print banks are separate and distinct from the counters and the total in any counter may be printed in any print bank, if so plugged.

12. + All of the feed rolls on all the types of electric accounting machines are steel.

13. + The counter is operated by a timed electrical impulse. A constantly revolving shaft synchronized with the feed is clutched in with the counter wheel by the impulse through the hole in the card. This impulse energizes the counter magnet and trips the armature latch, engaging the counter wheel. The wheel is carried around to after "C" on the index when all the engaged wheels are declutched together.

14. X The reset motor is set into operation, turning the reset shaft. If the accumulating collar or clutch is engaged the reset gear will drive the counter wheel shaft. The counter wheel shaft has a shoulder cut in it into which two small pawls inside the counter wheel engage to turn the wheel back to zero.

MECHANICS OF ELECTRIC ACCOUNTING MACHINES

Place a check mark in the space provided for it if the machine has adding or control brushes or both:

		Adding Brushes	Control Brushes
1.	Vertical Tabulator - - - - - - - - - - - - - -		
2.	Standard Tabulator - - - - - - - - - - - - - -		
3.	Automatic Control Tabulator - - - - - - - - -		
4.	Electric Accounting Machine Type 285 - - -		
5.	Electric Accounting Machine Type 297 - - -		
6.	Electric Accounting Machine Type 302 - - -		
7.	Alphabetic Accounting Machine - - - - - - - -		

8. _____ The chief advantage of the automatic plugboard is its compactness.

9. _____ Each brush is connected to a wire which carries the electrical impulse from the adding brush to the adding brush tube on the plugboard.

10. _____ The carry-over position is the last position to the left in a counter which is used for accumulation of the carry-over from the counter wheel to its right. It is not operated by a magnet and consequently cannot be used for the addition of digits greater than one.

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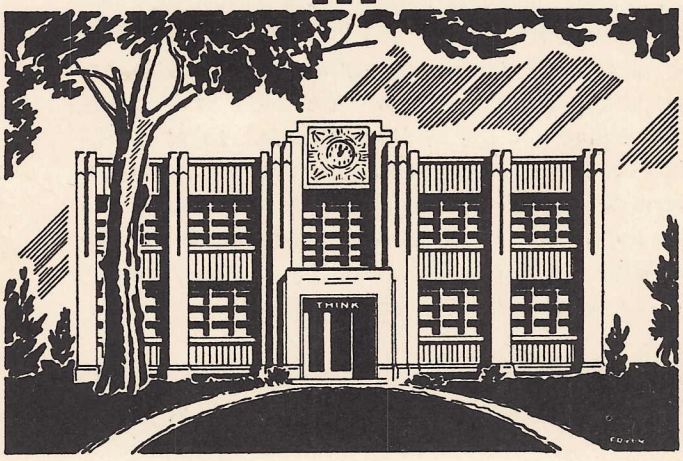
14. _____ The reset motor is set into operation, turning the reset shaft. If the accumulating collar or clutch is engaged the reset gear will drive the counter wheel shaft. The counter wheel shaft has a shoulder cut in it into which two small pawls, inside the counter wheel engage to turn the wheel back to zero.

15. + The counter wheels are geared to the top counter brushes and the figure in the wheel positions the top counter brush on the proper segment in the top counter molding. The brush remains stationary on the top counter segment during the printing operation. Each position in the counter is, during the total printing operation, connected to the corresponding print magnet. The magnet, however, is not energized until the proper time when the emitter completes the circuit and trips the stop pawl. The emitter is synchronized with the print head so that only when the proper tooth of the type bar is opposite the stop pawl is this circuit completed. Completing this circuit trips the stop pawl and stops the type bar at the figure in the counter. The type bar is held in this position until after the hammers trip and the total is printed. After the printing is complete the reset mechanism resets the counters and returns the print unit to its normal position.

15. _____

DEVELOPMENT OF INTERNATIONAL BUSINESS MACHINES CORPORATION

LESSON NO. 1



MANUAL OF INSTRUCTION

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 1—1—1

"THERE is no saturation point in education if you follow sound principles, and you must apply this motto to business. You are going to find it necessary to make a thorough study of whatever line of business you engage in. You must acquire wisdom in addition to knowledge. Wisdom is the power which enables you to use your knowledge to advantage. . . .

"There is only one way to gain knowledge and that is through study. Right here a good many fail because that means reading books, listening, discussing, observing and thinking. You must not overlook any one of these things. Read everything the company publishes for you in the way of instruction; discuss the business with every one with whom you come in contact, listen when any one talks about the business—be a good listener, observe, study through observation."

President,

INTERNATIONAL BUSINESS MACHINES CORPORATION.

Development of International Business Machines Corporation

This first lesson is given you to help you to know your own company better. Whatever your particular duties may be, either now or in the future, such knowledge is certain to be helpful to you. The better you understand what your company is and what it is doing, and why, the better you can adapt your own working methods and ideas to the company's policies and purposes; and so, by becoming more useful, become more valuable to yourself as well as to your employers.

It is well worth your while, then, to learn all you can about your company as an institution; to learn why, and how, it came into existence; why and how it grew to be what it is today; its present organization, scope and activities; and why and how it seems destined to experience far greater growth in the future.

It is still more worth your while to realize what, in its largest, truest aspect, this company is; to see this institution in which your own work plays a part, as a great servant of modern civilization. You can best accomplish this by studying its work as a part, and an increasingly important part, of the entire development of modern business; by studying the relation of its present organization and activities to modern business organization as a whole; and finally, by learning something of the immense, varied, and still untouched fields of usefulness which lie ahead of us.

HOW BUSINESS HAS GROWN

Industry in America, and for that matter throughout the civilized world, may be said to have passed, or indeed to a considerable degree to be still passing, through three successive stages of operation, which are fairly well described as:

1. Individual operation
2. Corporation control
3. Merger of corporations.

This history of INTERNATIONAL BUSINESS MACHINES CORPORATION itself follows, in an extremely interesting and significant way, this same general sequence of business development. Our own company as we know it today has passed through just such successive stages, which will be traced in detail a little farther on in this lesson.

But there is a still greater, special significance for every IBM man in the study of the part played by his own company in this continual growth of business into constantly larger, more widely extended, and more elaborately organized units.

In all the world-wide and enormously varied activities of INTERNATIONAL BUSINESS MACHINES CORPORATION today, there is plainly to be seen a single unifying principle. And this same basic principle—whether anyone realized it or not—has been present in these activities from their very beginnings. It does not matter in the least that these beginnings occurred, as they did, in the form of widely separated efforts by individuals or little groups who very probably were not, then, even aware of each other's existence.

The important point is that each of them was trying in his own way to accomplish something that was, in principle, essentially a part of a single, larger task. That it was a thing worth doing, and that they went about it in fundamentally the right way, is proved by the fact that INTERNATIONAL BUSINESS MACHINES CORPORATION today, after forty years of experience, study, and research, still relies in great part upon the principles they first discovered and developed. And that the unifying principle existed, and so made the gradual combination of their individual efforts a sound and logical process, is proved by the consistent record of growth and success which followed this combination, culminating in IBM today.

Now, what is this basic central principle of all IBM activities, past, present, and future? It may be defined as the application of the speed, the economy, and above all the precision which can only be obtained by the fullest possible use of mechanical methods, to the measurement, assembly, and statement in usable form—in one word, the *organization*—of the essential facts without which no business can be successfully conducted.

Once this principle is clearly understood, two things become evident. The first is, that without the kind of service to which this principle points the way, and to render which all IBM products are created, business organizations of the combined size and efficiency we know today literally could not exist at all.

The second is that consequently, as business organizations continue to grow in size and in complexity, the need and therefore the market for IBM machines and service grows still more rapidly, and *at a steadily increasing rate.*

The moment a business grows beyond the point where one man can still carry all its essential facts in his head, a need begins for mechanical methods of organizing these facts so that the business can be effectively managed. And with each successive increase in the size of that business, the demand for more speed, economy, and precision in dealing with the multiplying array of essential facts becomes more insistent.

What does this mean for us? It means that, phenomenal as the growth of IBM service has been during the past forty years, the still undeveloped field ahead of us today—the field for future growth—is actually greater now in proportion to our present business than was the total field open to the parent companies of IBM at the time of their incorporation.

OUR COMPANY—THE EARLY DAYS

It is extremely significant that all three of the individual developments which became the three main foundations of INTERNATIONAL BUSINESS MACHINES CORPORATION took place almost simultaneously; and that this was in the latter half of the decade 1880-1890.

This five-year period was one of the most important in the whole process of transformation of American business from small individual enterprises into huge and complex organizations. This period marked the peak of the great era of railroad expansion; it was the time of most active growth of the early industrial giants, such as the Standard Oil Company, and of the first practical industrial application of electricity.

In those years between 1885 and 1890, Edison was developing the first successful electric generating and distributing system; Tesla was perfecting the alternating current motor; Sullivan and others were designing the first "skyscraper" buildings; and business everywhere was already beginning to feel the inadequacy of existing methods of organization and control when confronted by the vast expansion which these new developments were setting under way. But adequate organization for this new era required, first of all, better ways of weighing, measuring, recording, and organizing the essential facts with which business has to deal. And when a need begins to be felt acutely, men begin to search for the remedy.

So it is not merely a coincidence that 1885 is the first significant date in IBM history. In that year Julius E. Petra of Gallipolis, Ohio, secured a patent on an entirely new device which he called a computing scale. That invention was the earliest of the cornerstones of INTERNATIONAL BUSINESS MACHINES CORPORATION. From it, in great part, grew the entire business of what for many years was known as the Dayton Scale Division of our company; its influence is still felt in the manufacture of our industrial and computing scales.

And while Mr. Petra, out in Ohio, was at work on his scale, in Washington, D. C., Dr. Herman Hollerith, a distinguished statistician who had been employed by the U. S. Government in the compilation of the 10th Census, was wrestling with what then seemed like an entirely different problem, but was in reality merely another approach to the same fundamental search for speed, efficiency, and precision in dealing with business facts.

Dr. Hollerith's approach to the problem was by personal experience of the enormous difficulty the Census Bureau was having in reducing the mountains of facts gathered by the census takers into usable form. The facts had been collected, as the law provided, in 1880; but five years later the Bureau was still struggling to compile them. And at the rate at which the country was growing, it was not hard to foresee a time when, with existing methods, it would be time to take the next census before the last one had been published. So Dr. Hollerith set to work to find a way by which all this recording, tabulating, and analyzing of facts would be done by machinery.

The 10th Census Report was finally completed in 1887, with the 11th Census only three years

away. But by that time Dr. Hollerith had worked out the essential features of his mechanical system for recording, compiling, and tabulating census facts—a system which was to prove useful in far wider fields than those of the census, and to introduce a new speed, efficiency, and precision into the organization of large masses of facts.

His system was fundamentally simple. It consisted essentially of a method of recording the facts of any given situation—for example, the census description of one person—by punching holes, according to a definite pattern, in a piece of paper. The original plan used strips of paper; but Dr. Hollerith soon found it was better to use a separate card, of standard size and shape, for each "unit situation."

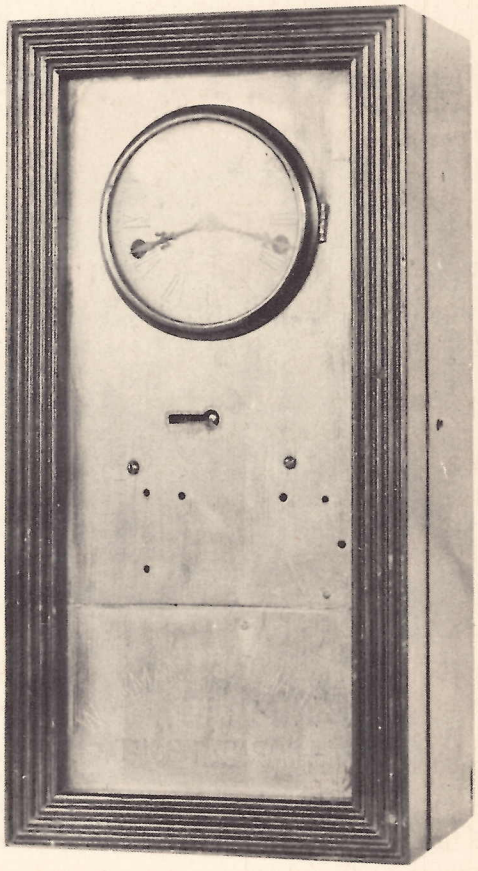
A pre-arranged code assigned a definite meaning to each separate position on the card. A hole punched in that position would then actuate electrically-operated mechanisms which dealt with the particular data which that position represented, functioning as counting or adding devices, either singly or in various combinations. as the result sought might require.

Dr. Hollerith's first customer, however, was not the U. S. Census, but the City of Baltimore, whose authorities he persuaded to let him try mechanical tabulation on the city's mortality statistics. Other early users of tabulating machines were the Bureau of Vital Statistics of New Jersey, and the Board of Health of New York City. The results were successful; and the compilation of vital statistics is today, the world over, a recognized task for tabulating machines.

While, in these years of beginnings, the foundations were thus being laid, in Washington for the Tabulating Machine Division and in Ohio for the scale business of IBM, in two other still more widely separated places work was simultaneously going forward which was to result in the development of the third major element in modern methods of business organization and control—the accurate and efficient recording of working time.

Willard L. Bundy, a jeweler of Auburn, New York, had observed the cumbersome methods then in vogue, in what were then the most modern and progressive factories in the country, for measuring and recording the time spent on the job by each workman. Each man was given a brass identification check bearing the number assigned him, which he had to present to a time clerk each time he "checked in" or "checked out." The system was slow; it required a force of clerks to do nothing else but record time; and it was of course productive of endless disputes between workmen and time clerks over the accuracy of entries.

Mr. Bundy devised, and in 1888 patented, a mechanism which at one stroke did away with both the disputes and the time clerks. Instead of the brass check, each workman was given a key



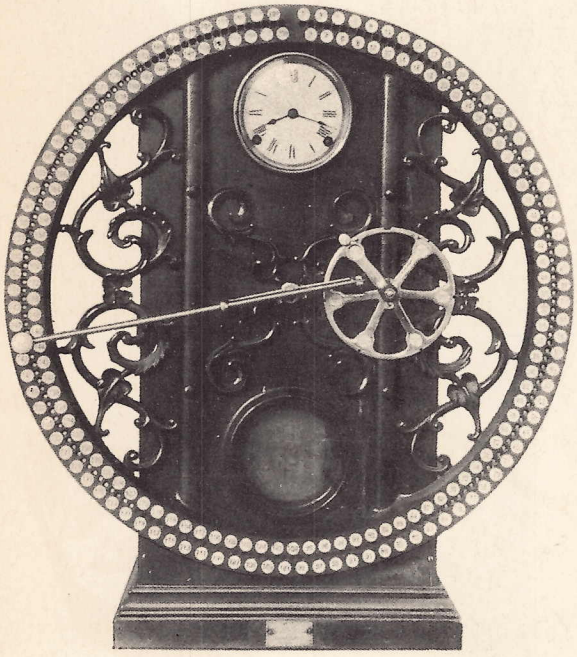
Bundy Key Recorder

bearing his number. To check in or check out, he inserted this key in the mechanism and gave it a quarter-turn. This printed his number, and the time, on a roll of paper. The printing mechanism was of course actuated and controlled by a clock; and the roll of paper became the plant time-record.

At this very time, Dr. Alexander Dey, a Scottish physician who was also a distinguished

mathematician, was studying the problem of time-recording. In this same year, 1888, he patented a time-recorder radically different from that of Mr. Bundy. Its principle was at once so sound and so simple that it is still in use, essentially unchanged, in the dial-type recorders of today; the only improvements so far have been merely refinements in detail and extensions of its application.

In the dial recorder neither check nor key was needed. Workmen's numbers were posted around the circumference of a large ring on the front of the machine. Each number marked a corresponding hole in the ring. A pointer, mounted on a pivot at the center, could be swung around the circle; at its tip was a punch fitting into the holes. The workman had only to swing the

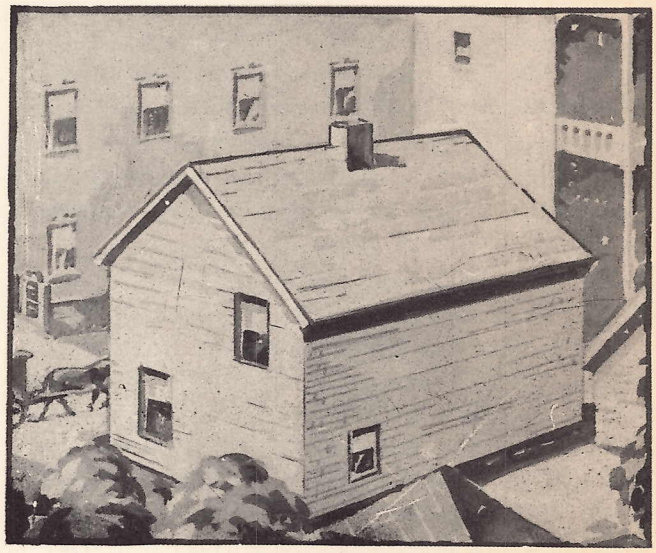


An Early Type of Dial Recorder

pointer to his own number, push the punch in the hole, and thereby print the time record opposite his number on a prepared sheet inside.

The year 1889 was one of important developments in each of the three major tasks of measuring materials, measuring the time and labor, and recording and tabulating the facts of both. It may be said, in fact, that with this year, which saw the first actual commercial development of the inventions perfected in the preceding years, the history of INTERNATIONAL BUSINESS MACHINES CORPORATION really gets under way.

In this year, Orange O. Ozias, a Dayton, Ohio, business man, heard during a business trip to Detroit of a wonderful new invention—a computing scale—the patents to which had been bought from the inventor Julius E. Petra in 1888 by R. E. Hull, a Detroit scale salesman. When he returned home, he told Edward Canby, a Dayton manufacturer, about it. His enthusiasm was so great that Mr. Canby immediately joined him; the two went to Detroit at once, and after considerable negotiation persuaded Mr. Hull to sell them the patents—the Petra patents. In that same summer, 1889, Mr. Canby and Mr. Ozias started, in a little frame shop in the rear of the Callahan Power Building on Main Street, in Dayton, to manufacture the world's first computing scales.



The First Computing Scale Company Factory

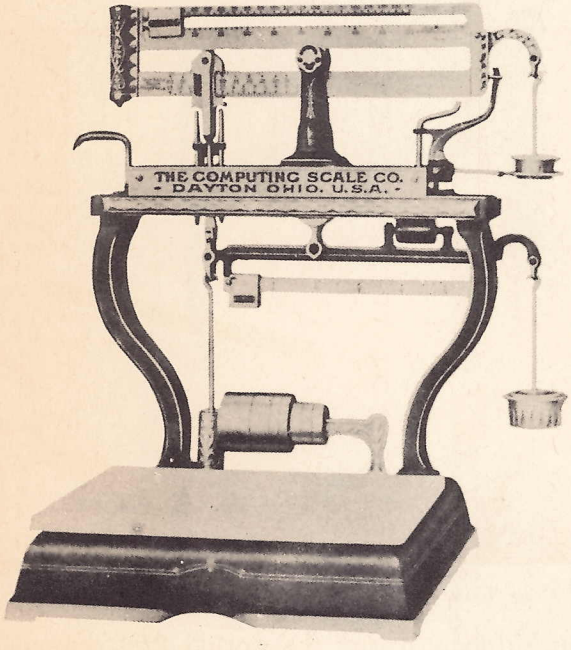
While Mr. Ozias and Mr. Canby were arguing with Mr. Hull in Detroit, a series of meetings, equally important for the future of IBM, were in progress in Binghamton, New York.

Harlow E. Bundy, brother of Willard Bundy and a lawyer by profession, had become interested in the possibilities of the Bundy time-clock, and had enlisted the support of Senator George E. Green, of Binghamton, and William L. Ford, of Deposit, N. Y. On September 30, 1889, these three men, together with A. Ward Ford, William L. Ford's son, incorporated the Bundy Manufac-

turing Company—the first to be incorporated of the parent organizations of INTERNATIONAL BUSINESS MACHINES CORPORATION, and the first time-recorder company in the world.

Again, during this same summer of 1889, down in Washington a commission of three experienced statisticians, appointed for that purpose by the Superintendent of the Census, was busy with a series of exhaustive practical tests of all then-known mechanical methods and systems for counting, adding, or tabulating data which might be practicable for use in the 11th Census, which had to be taken the following year.

On November 30, 1889, this commission reported that the census records could be transcribed by the Hollerith method of card punching

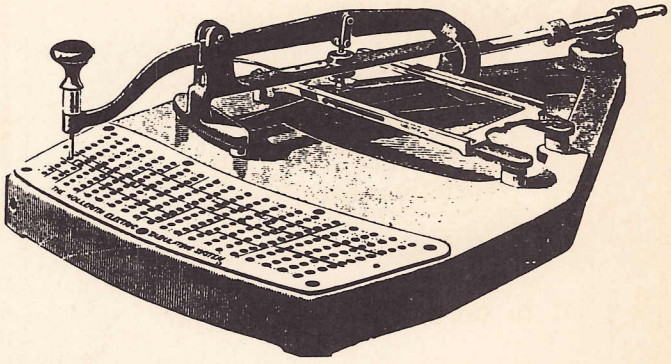


The First Computing Scale

in not more than three-fourths of the time required by any other system; and that the data could be tabulated by Hollerith machines in not over one-eighth of the time required by any other available method. As a result of this report, the Hollerith system was officially adopted by the United States Government for compiling census returns; and Uncle Sam thereby became what he has been continuously ever since, and remains today—the largest single customer of INTERNATIONAL BUSINESS MACHINES CORPORATION.

The record of 1889 calls for one more entry. In that same year Dr. Hollerith hired an office-boy.

Otto E. Braitmayer

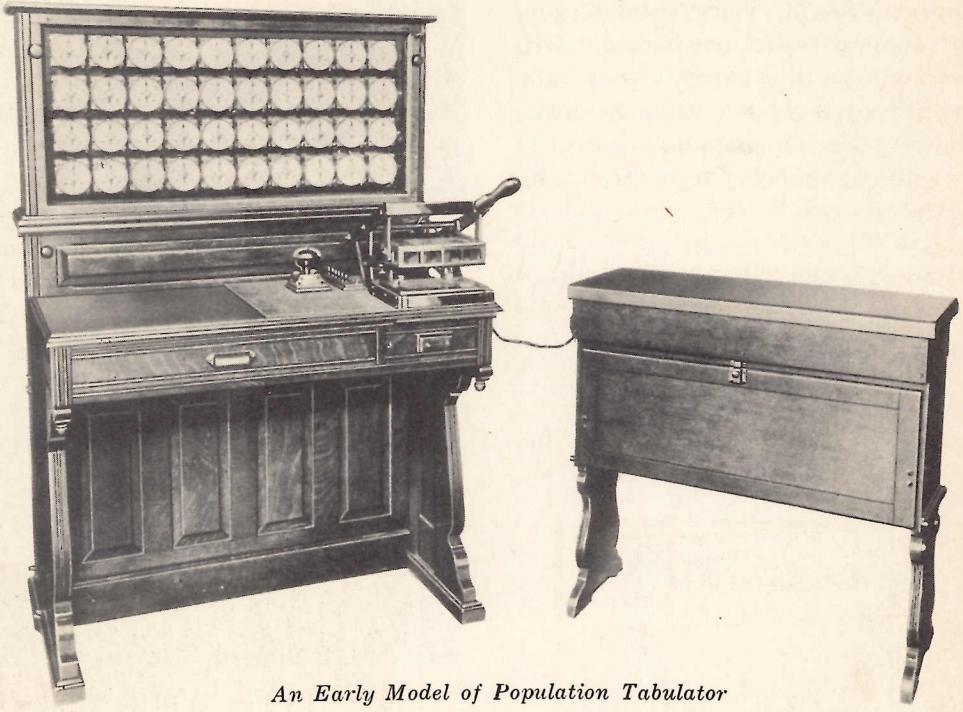


The First Hollerith Keyboard Punch

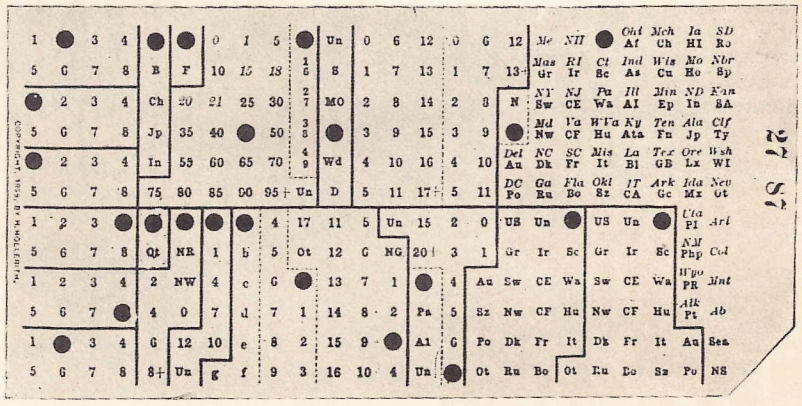
This would not in itself be important; a great many office-boys were being hired in those days, and a still greater number have been hired since. But this particular office-boy's name was Otto E. Braitmayer; and he is today Vice-President of INTERNATIONAL BUSINESS MACHINES CORPORATION, and charter member of the club to which Mr. Canby and Mr. A. Ward Ford also belong—IBM's Forty-Year Club.

GROWTH OF THE COMPANY—
THE SECOND STAGE

The 11th U. S. Census, begun in 1890, attracted world-wide attention. It was the first enterprise of its kind in which the returns were compiled and tabulated by machinery. The cards used in this earliest major application of IBM principles were punched on a machine of considerably more primitive character than the IBM card punches of today. This first machine had a perforated board, bearing letter or figure characters beside each hole. Each character represented, in the code, certain information to be entered on the card. Over this keyboard swung a pointer, or index finger, whose movements, by a principle similar to that of the pantograph, were duplicated on a smaller scale by the actual punching device in the rear of the machine. The card being accurately fixed in a holder, pressing down the index finger into the proper hole in the keyboard, punched the card in the corresponding position.



An Early Model of Population Tabulator

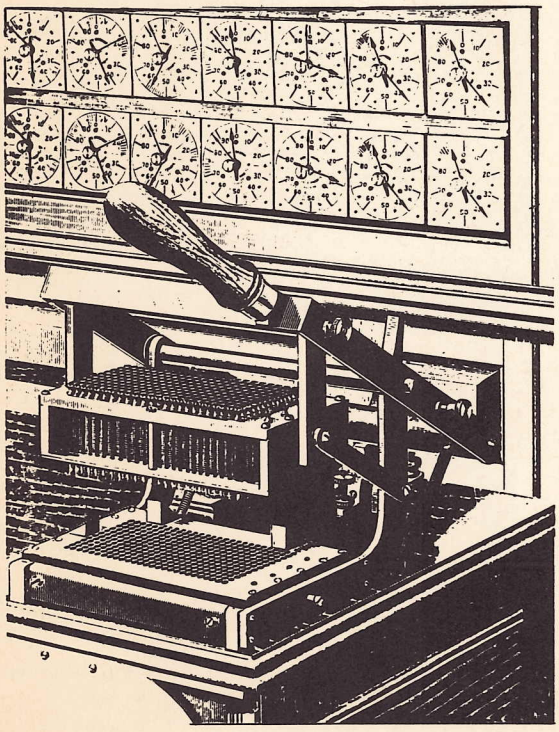


Industrial Population Census Card Covering the Twelfth U. S. Census Compiled in 1900

The machine by which the items punched in the cards were counted or tallied, known as the tabulator, resembled a small upright piano. It

consisted of three parts: (1) the press, or circuit-closing device, which was what would be the right-hand end of a piano keyboard; (2) the dials or counters, which were located in a position corresponding to the upper face of a piano in which the music rack is set; (3) the sorting box, which stood as a separate unit at the right of the piano-like apparatus. The bed plate of the press was formed by a series of mercury-filled cups corresponding in number and arrangement with the punch positions on the cards. Above this plate was a reciprocating box provided with a number of contact points corresponding in position with the center of the mercury cups, so that when a card was placed in the press and the handle brought down, these points formed circuits in positions corresponding to the holes in the punched records, which registerd the results on the dials.

If, while certain facts were being tabulated, it was desirable at the same time to sort or arrange the cards according to any classification, a sorting box was employed. This sorting box was

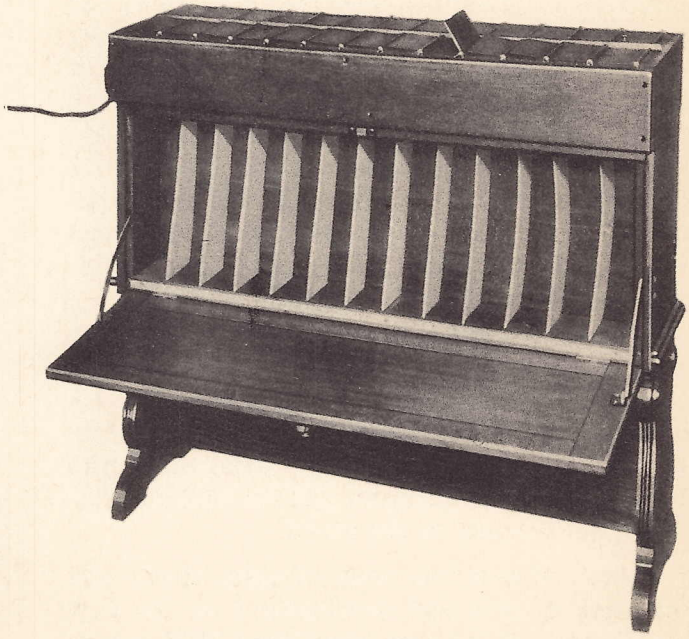


Press or Circuit-Closing Device

suitably divided into twenty-six compartments, each of which was closed by a lid held against the tension of a spring latch, which formed the armature of a suitable magnet. The magnets were connected with the binding posts of the press, according to the data by which the cards were to be sorted. When a card was put in the press, the armature corresponding with the given record was attracted, thus releasing the corresponding lid, which remained open until the card was deposited in that division and the lid again closed by hand.

The sorters and tabulators first built by Dr. Hollerith did not, in appearance, greatly resemble today's machines. But their fundamental principle was the same.

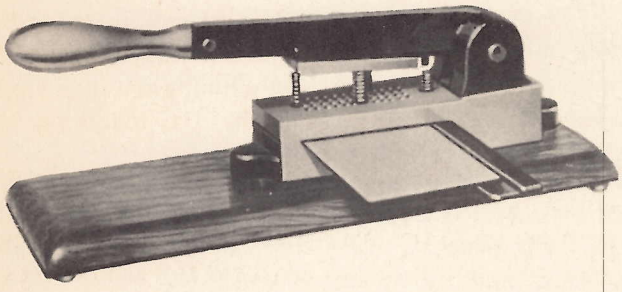
Dr. Hollerith's task was in fact so accurately visualized and so soundly performed by him, that no essential change has ever been necessary in the basic process, in its three steps of punching, sorting, and tabulating; though the application of his principles has been extended into fields far wider and more varied than he, perhaps, dreamed—fields whose limits we cannot even now, after forty years of continual growth, fully comprehend.



Sorting Box

The complete success of the Hollerith system in the work of the 11th U. S. Census led in the following year to its adoption for the Austro-Hungarian Census; and at about this same time, brought inquiries as to the adaptability of ma-

chine tabulation to the audit of railroad freight accounts and calculation of commodity statistics. Experiments were made in the offices of the Auditor of Freight Accounts of the New York Central Railroad. They were completely successful; and thus began the enormous commercial, as distinguished from governmental, application of electric accounting.



Original Hand Gang Punch

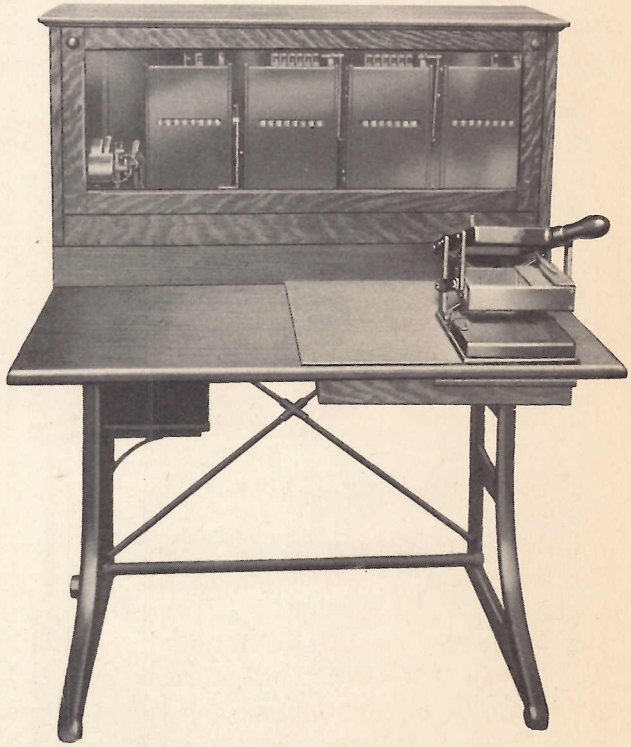
At the same time, the extension of the system to a variety of commercial uses brought about the first radical change in the detailed design of the machines. The three basic units—punch, sorter, and tabulator—remained the same; but the original keyboard punch gave way to a key punch substantially identical in design with that still in use today; different and varied card designs were developed for the various new uses; and the process of refinement and addition of special devices for broadening the field of application of tabulating methods, which has continually characterized IBM tabulating equipment ever since, was thus begun.

In the year 1891, while Dr. Hollerith was busy with these new problems of application, on March 20th the Computing Scale Company with a capital of $160,000 was incorporated in Dayton, Ohio—the second of the parent IBM companies to take on corporate form, and the first computing scale company in the world.

There followed two years of quiet, steady and intensive growth and development on the part of all three of the now-established IBM parent enterprises; and then, in 1893, occurred two other separate events, each of which was of considerable significance in our organization's history.

The first of these was the incorporation, in Syracuse, New York, of the Dey Patents Company (the name soon after was changed to the Dey Time Register Company).

Dr. Alexander Dey had two brothers, John and Robert, who had emigrated to America, had become successful here, and ultimately founded and conducted a large department store in Syracuse. Naturally, as thrifty Scottish employers of labor, they soon acquired a practical interest in the problem of control of their employees' working time; and their brother was finally able to interest them in his time-recording device. The three brothers were the sole owners of the new company. John and Robert supplied a small amount of working capital, and a workshop over their store. Dr. Alexander Dey made frequent visits to America to supervise the mechanical development of his invention; but he remained all his life a British subject and resident of his native Scotland.

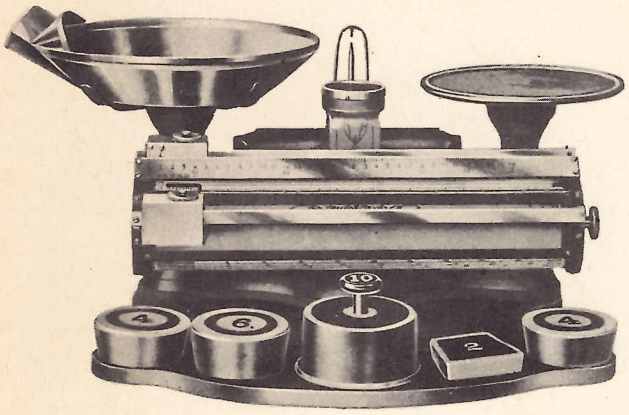


An Early Type of Commercial Tabulating Machine

The advantages of the Dey recorder were so obvious that the new company throve, and within a few years moved into a building of its own. The dial recorder was simpler and easier to operate than the Bundy recorder; and it appealed to employers because of the clean and compact

form of its records, and above all the fact that the time sheets, printed in advance, carried columns for the six registrations ("Morning In," "Noon Out," "Noon In," "Night Out," "Extra In," and "Extra Out") and the machine could be set to print each registration in its proper place so that it could at once be identified and posted; whereas there was no way to identify the registrations on the tape of the key recorder except by following the entire record through in order.

The second significant event of 1893 took place in Dayton, where Samuel M. Hastings and Walter K. Mills were appointed general sales agents for the Computing Scale Company in Illinois, Iowa, Wisconsin, and Minnesota. From this grew the first general, nation-wide sales organization for the Computing Scale Company, and with it began the association of Mr. Hastings with IBM destinies which, happily, still continues, and which qualified him in 1933 as the fourth member of the IBM Forty-Year Club.



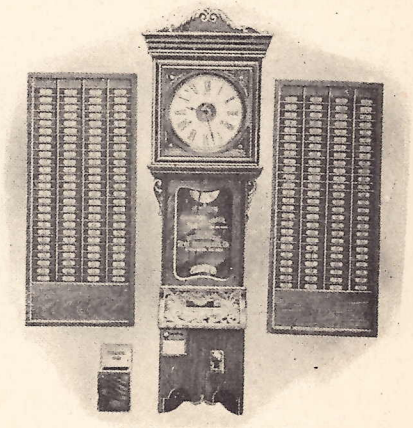
An Early Type of Even-Balance Computing Scale

In 1894, another important competitor entered the time-recorder field. Daniel M. Cooper of Rochester, N. Y., previously known as an inventory of laundry machinery, in this year patented the world's first card time-recorder; and J. L. Willard, a Rochester laundry operator, formed with F. A. Frick, an undertaker, the Willard and Frick Manufacturing Company to market Mr. Cooper's invention under the trade name "Rochester."

This was a great step forward in time-recording mechanism. The Rochester recorder used a printed card, divided by heavy horizontal lines into seven equal spaces for the seven days of the week. Each day space was subdivided by a light horizontal line into an upper space for morning, and a lower space for afternoon registrations; a vertical line divided all the horizontal spaces into an "in" space, on the left, and an "out" space, on the right.

The original Rochester card had no provision for overtime registration. The Rochester recorder, therefore, in this respect was inferior to the Dey recorder. On the other hand, it possessed an automatic setting device which gave it in that respect an advantage over the dial machine.

Dr. Dey's first recorder had, inside the large ring, a small ring marked with six positions corresponding to the six registration classifications. This ring had to be set by hand for each successive registration period; and finally, after the last overtime worker had left at night, turned back to the "Morning In" position to be ready for the first registration next day.



Rochester Card Time Recorder

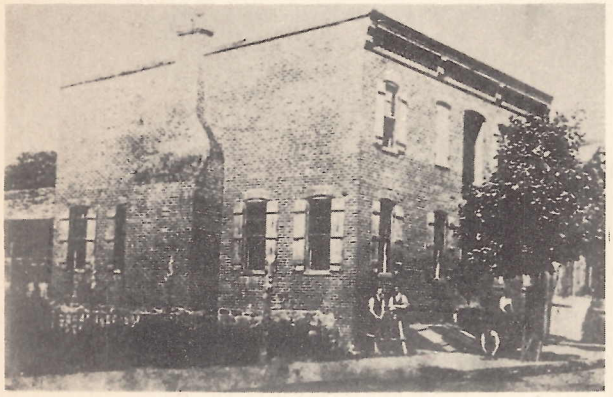
In the Rochester recorder, an abutment, actuated by the same clockwork mechanism which operated the printing device, automatically lifted the card-holder once every twelve hours, so that the card when inserted fitted into the correct position for registration in the correct day space and morning or afternoon sub-space. But the workman had to adjust the holder laterally for "in" or "out" registration; and once a week the mechanism had to be set back so that the day record would be correct.

All the engineers and inventors, from the earliest days, who have played a part in the

development of the great IBM line of today, have had a keen appreciation of the value and importance of making all operations, as far as possible, automatic; in 1895 the Computing Scale Company brought out the first successful automatic computing scale, of the cylinder type, and the first hanging cylinder computing scale.

In 1896, another of the men destined to have great influence upon the future history of IBM made his debut in its affairs, when George W. Fairchild was persuaded by Harlow E. Bundy to become a substantial stockholder in the Bundy Manufacturing Company and to take an active part in its direction. It was in 1896, also, that Dr. Hollerith incorporated his business under the name of the Tabulating Machine Company, with a New York charter.

In this same year the Hollerith system was adopted for the Imperial Russian Census. Shortly after its incorporation, the Tabulating Machine Company purchased a tract of land in Washington at the corner of Thirty-first Street and the C. & O. Canal, which still remains the site of the Washington plant of INTERNATIONAL BUSINESS MACHINES CORPORATION. A small brick building on this property had been used by Dr. Hollerith for several years as an experimental laboratory and workshop. The plant soon outgrew this building; another was erected, and still later more land had to be purchased and several other buildings added to the plant.



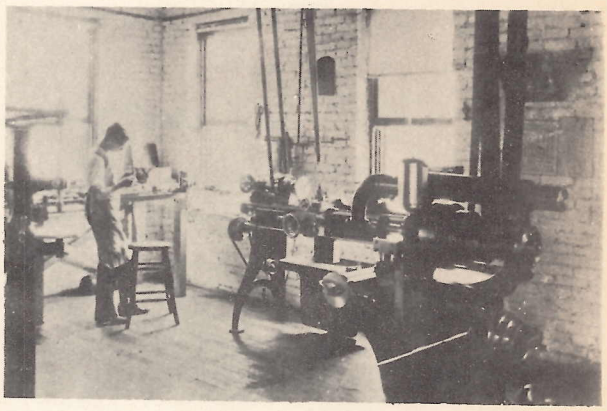
First Tabulating Machine Company Factory

One other event of 1896 deserves mention. In that year the Stimpson Computing Scale Company was organized in Detroit. This company was later to be included in the process of merger and consolidation which constitutes the third stage in the history of INTERNATIONAL BUSINESS MACHINES CORPORATION, and which is next to be described.

GROWTH OF THE COMPANY— THE MERGER STAGE

For American business generally, 1891 to 1896 was a period of severe business depression, in which the "panic of 1893" was the most acute stage. It was proved then, as has been repeatedly proved since, that in a sense "hard times are good times" for any business whose success depends upon its ability to bring home to other business men their own need for greater speed, economy, and precision in their own operations.

Business depression throws a merciless light upon many wastes and inefficiencies, small and great, which had been ignored or tolerated in times of easy profits. It consequently supplies a sales argument of tremendous power to any organization whose service consists in eliminating, or at least aiding to eliminate, those wastes and inefficiencies.



First Workshop of the Tabulating Machine Company

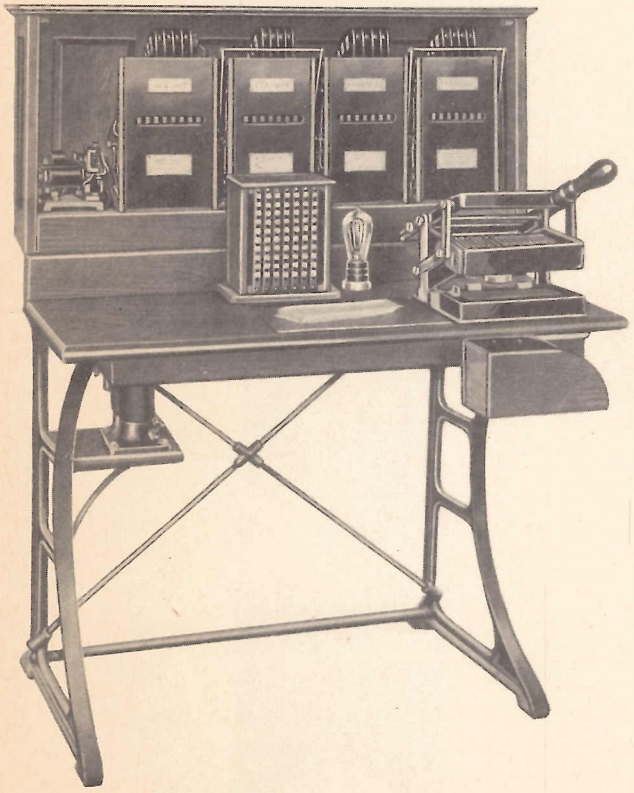
Unfortunately,—like the man in Arkansas in the old story, who was reminded that his roof leaked only when it was raining too heavily to permit him to mend it,—too many business men realize their acute need for more accurate and economical methods of control of their business only when they are already in such straits that they can not, or at least dare not, spend even the relatively small sum needed to put their system in order.

But when business begins to mend, many business men take the lesson to heart. Not all of

them prove capable of learning from experience; but a sufficient number do so, to make the period of recovery immediately following a depression almost invariably one of exceptionally rapid growth and progress in the introduction of improved methods—which means the same kind of growth and progress for institutions of the IBM type.

During the years from 1896 to 1901 this proved emphatically to be the case. In those times the Tabulating Machine Company had, to all intents, no sales organization. Its problem was to secure manufacturing facilities to meet the demands upon it. Even the enlarged Washington plant was not sufficient; it was necessary to place work with an outside organization.

The result was that the first mechanical key



Type of Tabulator First Used by New York Central Railroad

punches of the new type—substantially identical with those in use today—were designed and built by the Taft-Pierce Manufacturing Company of Woonsocket, Rhode Island, under the supervision of Mr. E. A. Ford. The first order was for 200 punches to be used in the 12th Census. Recognizing Mr. Ford's ability as an inventor and designer, Dr. Hollerith persuaded him to join the Tabulating Machine Company—to become, eventually, dean of the staff of IBM's Engineering Division.

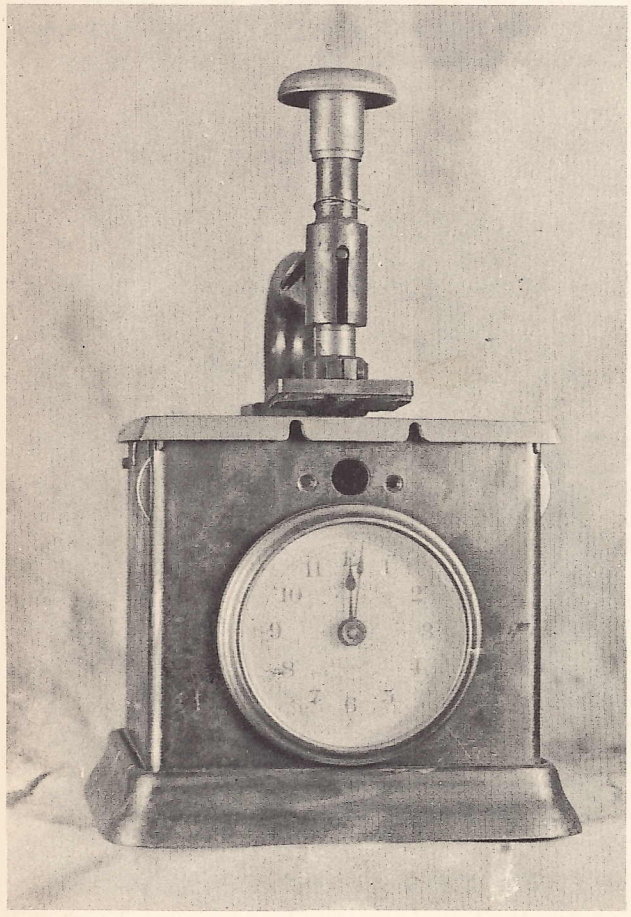
Aside from the greatly extended application of tabulating methods to the 12th Census, the demand for tabulating equipment grew almost entirely out of the pioneer installation in the freight office of the New York Central Railroad, already mentioned. This installation functioned, during these years, as a permanent exhibit of tabulating mechanism. No President, Comptroller, or other high financial officer of any railroad in the country, visiting New York, considered his trip complete until he had witnessed a demonstration of the New York Central's

The Bundy Factory, Water Street, Binghamton, in 1893

method of auditing freight accounts by machinery; and the result, in a great many cases, was an immediate order for identical equipment for the visitor's own railroad. At about this time, also, and as a result of this same continuous demonstration provided by the New York Cen-

tral, began the first application of tabulating machinery to actuarial work for insurance companies—the second important commercial field to develop for electric accounting.

Precisely the same fundamental causes, in these same years, were bringing rapid growth in the time-recording field. Early in this period the Bundy Manufacturing Company outgrew its original plant—a leased space in an old grist-mill on what is now Commercial Avenue, Binghamton—and moved into a four-story building, which it completely occupied, on Water Street, Binghamton.



Stamp

In some ways a still more striking example of the effect of rebound from a depression was offered by the record of the Computing Scale Company. In the five years 1892-1897—to all intents and purposes its first five years in active business—it manufactured and sold 27,000 computing scales.

The year 1899, the tenth anniversary of the commercial beginnings of all three of the still-independent companies which were eventually to be merged in INTERNATIONAL BUSINESS MACHINES CORPORATION, was an especially eventful one in the time-recording field. In this year the Bundy Company signalized its tenth anniversary by calling in its entire field force—seven salesmen—to meet the fifty factory workers. Such excellent results followed, that these "get-together" meetings later became an annual custom;

An Early Model of Job Time Recorder

and in this way originated the far-reaching scheme of company conventions which from the first have played, and today still play, so vital a part in IBM progress.

In 1899, also, the Bundy company began the

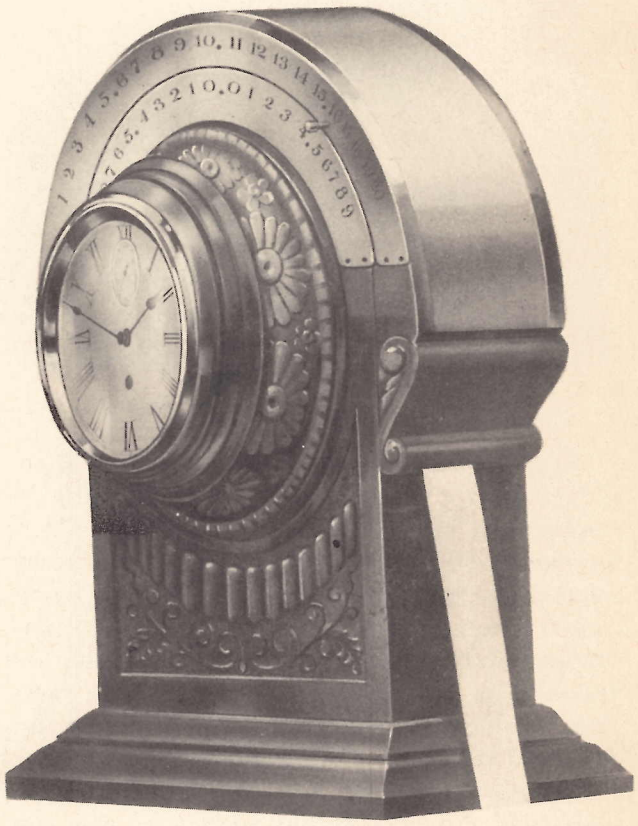
era of merger by acquiring the Standard Time Stamp Company, and adding time stamps to its line of products. In this year, too, it developed the first job time recorder—a step of much significance in American factory practice, leading, through closer, more accurate, and more detailed time control, toward the rapidly approaching era of standardized mass production which was to produce such mighty effects in the world's business structure.

Finally, at about this time came the first steps in export business, eventually destined to grow into today's world-wide extension of IBM manufacturing and sales. The pioneer in this huge and far-flung organization was Mr. A. R. Jennings, who went to England shortly before the turn of the century as sales agent for the Bundy Manufacturing Company. American mechanical devices and methods were then all but unknown in England; yet he soon developed a substantial and steady flow of orders for Bundy time-recorders. Very few American business organizations have a longer, and none a more successful record in international business than IBM.

On March 1, 1899, the Computing Scale Company organized the Moneyweight Scale Company, under Mr. Hastings' leadership, as its general selling agent for the United States and Canada.

As the 19th century drew to a close, the process of merger and consolidation in American business was well under way. The possibilities of the holding company, or the "trust," as it was popularly called in those days, for increasing the efficiency and improving the control of business, were being explored. In 1900, Mr. Fairchild organized the International Time Recording Company of New Jersey to take over the properties and business of the Bundy Manufacturing Company and its newly acquired subsidiary, the Standard Time Stamp Company, and the Willard and Frick Manufacturing Company.

At this time the Bundy company, thanks to its efficient sales organization and its initial lead—it began business, it will be recalled, four years before the Dey company and five before Willard and Frick—was the leading company in the field. It was producing about 100 key-type recorders a week, while Willard and Frick were marketing only about 40 card-type recorders. But as soon as the Bundy sales force was given the card-type recorder to sell, this situation changed. In a few years the figures had been almost exactly reversed—the new International company was making and selling about 100 card recorders a week, and not more than 50 key machines.

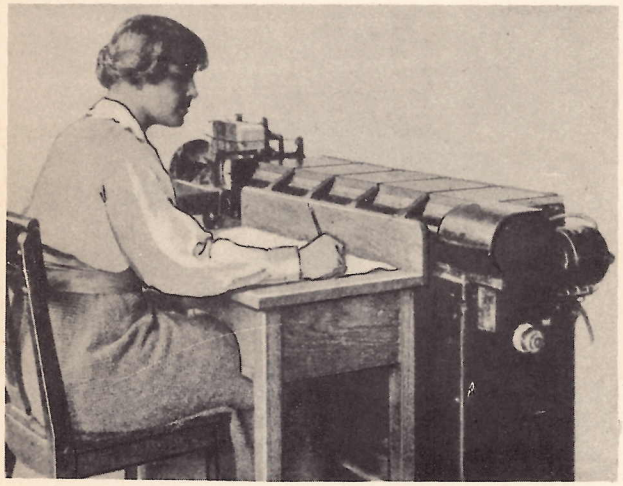


The Dey Time Register

Aggressive selling of the key recorder was in fact virtually abandoned shortly after the merger and the consolidation of all manufacturing at the Binghamton plant. In spite of this, orders for it persisted for a long while, so that it was impossible to discontinue its manufacture. It is a curious commentary upon British conservatism, that such orders continued from the British Isles

for many years after they had entirely disappeared from the American field.

In 1901, the device of incorporating a separate selling company, adopted in 1899 by the Computing Scale Company, was tried by the International Time Recording Company. The sales agent was known as the International Time Recording Company of New York. In this same year the parent company purchased and absorbed the Chicago Time Register Company.

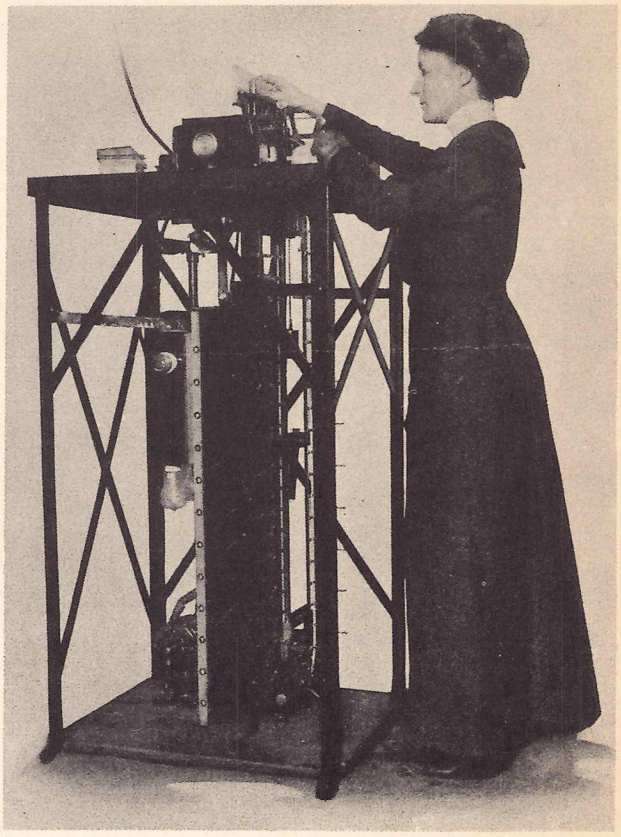


An Early Model of Tabulator

These various parallels in the histories of the IBM parent companies, it must constantly be emphasized, were not mere coincidences. These companies, still unrelated and probably scarcely acquainted, were operating in what was essentially the same field and were devoted to the same fundamental principles of speed, economy, and precision in the organization of business facts. They were growing in response to the same fundamental stimulus—the steadily increasing need of American business for better organization. Like causes presented like problems, and suggested similar solutions, at the same stage of development in each company.

So it happens that in 1901 the Computing Scale Company of America was organized in a manner similar to that of the creation of the International Time Recording Company. It was formally incorporated, October 23, 1901, with Mr. Hastings as President, to take over the properties and business of the Computing Scale Company, the Moneyweight Scale Company, and two Stimpson Scale Companies which had merged and were known as the Detroit Automatic Scale Company.

All three of the now well-established companies—the Computing Scale Company, the



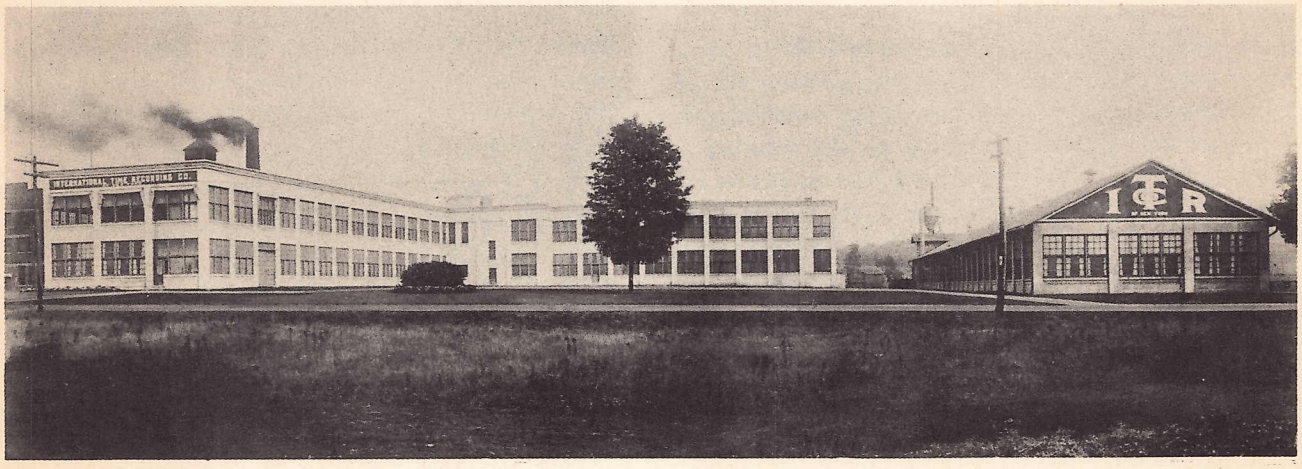
An Early Model of Vertical Sorter

Tabulating Machine Company, and the International Time Recording Company—continued their steady growth in the prosperous early years of the 20th century. Sales of computing scales, which had climbed by 1900 to better than 10,000 a year, mounted between 1900 and 1903 to still higher figures; in these three years 43,000 scales were manufactured and sold to retail stores throughout the country.

The International Time Recording Company, however, had one problem which did not trouble the others in any comparable degree. It had an active and aggressive competitor located in Syracuse, only some 75 miles away—the Dey Time Register Company.

Many were the keen business battles fought out during those years in the offices of prospec-

tive customers, over the respective merits of the card and dial time recorders. The truth of this was, and still is, that the card recorder is best for some situations, and the dial recorder is superior for others. But the keen rivalry had its good side; the resulting contest of wits inspired improvements in both machines from which the whole science of time control is still reaping benefits.



An Early View of the Endicott Plant

Neither company then had any "Engineering Division." Most of the improvements in the dial recorder originated in the keen brain of Dr. Alexander Dey himself, and were translated into actual performance by the mechanical skill of Mr. F. C. Venner. At the International plant in Binghamton, the veterans say, when an improvement was worked out "everybody was in on it." There was a suggestion box then, as there still is, and prizes for worthwhile ideas. Out of that suggestion box, thirty years ago, came the germ of the next forward step in time recording, which was perfected and adopted by the International company in 1904; fully automatic operation in setting for registration.

This was a challenge to Dr. Dey; in the following year he met it by introducing automatic two-color registration. This was a great step forward. By printing late arrivals and early departures in red, it not only simplified the checking of lost time but also had the moral effect of greatly stimulating punctuality.

Mr. Venner recalls that on the first morning after they had completed a two-color recorder and installed it in the Dey factory, at the same time explaining it to the employees, he and Dr. Dey went up on the roof of the old Syracuse plant to watch the workmen come in. "They used to stroll in as casually as you please," says Mr. Venner, "but that morning Dr. Dey and I had plenty of chuckles. The late-comers were fairly running to escape the red registration."

The response of the International company to this improvement was one of far-reaching importance, although it attracted little attention at first. In this same year, 1905, it completed the first electric-control system of secondary clocks, actuated and regulated from a single master clock, from which have since grown the great systems of time-control and programming which are virtually indispensable today not only in business and commerce but also in educational work.

While on the subject of mechanical development, it may be well to step aside and look in on the progress being made during these same years in tabulating machines.

Until about 1903 the Tabulating Machine Company was still making sorters and tabulators practically identical with Dr. Hollerith's original designs. But Dr. Hollerith and Mr. Ford were at work on an automatic tabulator. This machine, at first called an "integrator," was eventually perfected to the point that it gradually superseded the original mercury-cup contact tabulators, and became the direct ancestor of the various IBM tabulating machines of today.

The earliest automatic sorters were those built for the New York Central installation, and were of the vertical type—the only reason for this

being the fact that the Freight Office of that railroad was badly cramped for space. The same principles, however, were soon successfully applied to the horizontal sorter. The basic methods of card-feed and counter operation developed at this time are those still in use on the latest and finest sorting and tabulating machines today.

With the production of these new and improved mechanisms, the demand for tabulating machinery in industry and commerce grew still more rapidly. It is said that from 1903 to 1911 there never was a time when the production of tabulating equipment was less than two months —frequently it was as much as six months— behind the orders. During this period the parts for all the machines were manufactured in various plants in different parts of the country, and assembled in a leased plant in Providence, R. I. Among the early customers, who first applied tabulating methods in the first decade of the 20th century, were the Eastman Kodak Company, the Yale & Towne Manufacturing Company; and Marshall Field & Company of Chicago.

In 1906, the corporate organization of the International Time Recording Company was simplified by transferring all the stock of the New Jersey company to the New York company, which thus became the parent organization. The New Jersey company was dissolved soon afterward. And in 1906, the company having outgrown its Binghamton plant, work was begun on a modern factory building at Endicott, N. Y., the first unit of the huge IBM plant still located— and still growing—there today. All operations were transferred to the new plant in August, 1907.

While on the subject of factory buildings, it might be mentioned that the Computing Scale Company acquired its present plant in a more painful and drastic manner. In October, 1909, its plant on First Street, Dayton, burned to the ground; only a few machines were salvaged. But by June, 1910, the new factory on Huffman Avenue, the main plant of the Dayton Scale Division, was in production.

In 1907 occurred the final step in what might be termed the "ground-clearing" consolidations preceding the creation of INTERNATIONAL BUSINESS MACHINES CORPORATION; the purchase by the International Time Recording Company of the Dey Time Register Company, and the transfer of the manufacture of dial recorders to Endicott.

It was, from every point of view, a logical and completely successful step, beneficial to all concerned, and particularly to American business in its need for the most efficient possible time-control system. For it now became possible to incorporate in both the dial and the card recorder the best features formerly peculiar to each—to make the dial recorder fully automatic, and supply the card recorder with two-color registration—which the patent situation had previously made impossible.

As a result, when business began to recover from its 1907 depression, the International Time Recording Company was ready to meet its needs with the best, most complete, and most flexible time control systems yet developed. It was then, as it has ever since remained, far in the lead in its field of service.

GROWTH OF THE COMPANY—IBM IS BORN

The continued progress of the Computing Scale Company of America, the International Time Recording Company and the Tabulating Machine Company, in the years after 1907, attracted the attention and aroused the interest of Mr. Charles R. Flint, who possessed one of the keenest constructive minds of that day in business and finance.

He became convinced that a merger of these three companies, each of which was producing what was in effect a single essential part in what should be a complete service—the measurement of materials, the measurement of working time, and the organization of the facts obtained by this measurement—was not only logical, but would result in a business institution entitled to rank among the foremost in the world. Around 1910, he approached all three companies with proposals for such a merger. After careful study of the plan from every angle, it was accepted; and on June 16, 1911, the Computing Tabulating Recording Company was incorporated as a holding company to take over ownership of the three parent concerns.

The task of bringing together three different and formerly distinct business organizations is always a difficult one, however logical from every

point of view the consolidation may be. There is a saying that "it takes three years to digest a merger." The Board of Directors of the new company fully realized this; they therefore sought an outstanding executive and leader, not previously identified with any of the component companies, to weld them impartially into a single harmonious unit.

Thos. J. Watson
President
International Business Machines Corporation

In 1914 they found him in the person of Mr. Thomas J. Watson.

Mr. Watson had had long, thorough and successful experience as a salesman and executive in the field of specialty manufacturing and business service, dealing with problems not unlike those confronting the new company. He brought to it a vision of the possibilities of development of business machines far transcending that of any other person, not merely in his new company but in the entire country. Under his leadership the Computing Tabulating Recording Company became a unified institution animated by a single spirit; a spirit of mutual loyalty, enthusiasm, and above all "divine discontent." Its rapid and steady progress since then has not only justified

the vision of the men who had played their several parts in its creation, but has carried it forward to the point where, as Mr. Watson himself has repeatedly said:

"IBM is not merely an organization of men; it is an institution that will go on forever."

TWO DECADES OF IBM PROGRESS

Under Mr. Watson's inspiration, one of the first important tasks to be undertaken—a task which continues to grow with each success—was the organization and extension of the business which the three parent companies had already independently developed outside of the United States. The first important step was the creation, November 29, 1917, of International Business Machines Company, Ltd., of Canada, to consolidate the Canadian business of the three original divisions—as, for simplicity, they will henceforth be called—of the company.

In this same year the Computing Tabulating Recording Company took over the American Automatic Scale Company, of Chicago, Ill. This firm manufactured automatic heavy-capacity weighing devices. It was re-named the International Scale Company, and became a division of IBM to carry on all business in industrial scales.

An immediate sequel to Mr. Watson's election as President was the energizing and systematizing of engineering, research, and inventive work. From the first he impressed upon the whole organization the vital need of constant improvement and extension of IBM service at every point and in every detail from basic design to final application.

This has meant the continual development of new and better machines; new and better design of existing machines; new and better ways of using all machines; new, wider, and evermore varied fields of use; and constant extension and improvement of the sales organization, to make IBM service more thoroughly available to the constantly increasing number of organizations which need it.

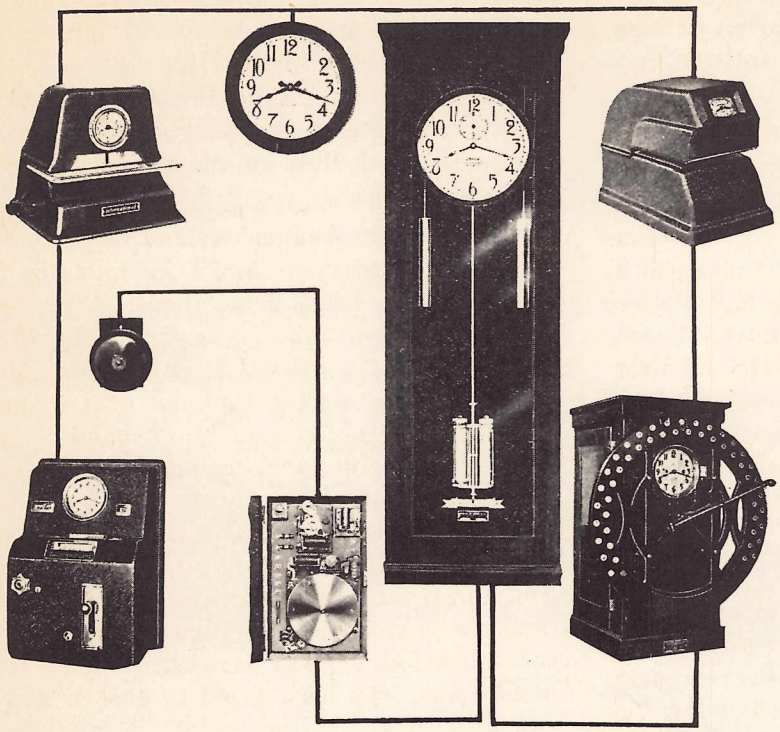
The effects of this policy began soon to be felt. The entry of the United States into the World War brought tremendous pressure upon our organization, through the nation-wide demand for help in organizing and controlling the tremendous production of munitions and machinery of all kinds. Practically every branch of the Government was faced with accounting and record-keeping problems in which only mechanical methods could possibly serve. Production statistics mounted day by day into figures of almost astronomical magnitude. Without constant improvement both in the design and the manufacture of IBM equipment the task could not have been shouldered.

This sudden, tremendous and really unhealthy growth, forced upon American industry by the war, was followed at demobilization by an equally violent reaction. The Computing Tabulating Recording Company, had, in either case, no more choice in the matter than all other American manufacturing firms. The disbanding of the huge war machine and closing down of munition plants, shipyards, etc., threw what, in proportion to the market which at that time existed, was an enormous surplus quantity of computing tabulating and recording equipment upon that market; and did so at the precise time when private business, itself struggling to re-adjust itself to peace conditions, was least fitted to absorb and make use of it.

The problem was in some respects actually more serious for our company than that of the depression of 1929-1933. It was solved successfully, not only by the all-round efficiency, energy, and resourcefulness with which Mr. Watson had imbued the organization, but especially by the success of the company's engineering and research staff in developing new and improved mechanisms to meet the wider field of post-war needs. It might be said that the company surmounted the problem of "second-hand" competition from its own products, by advancing the whole art of business machines so rapidly as to render these earlier machines obsolete.

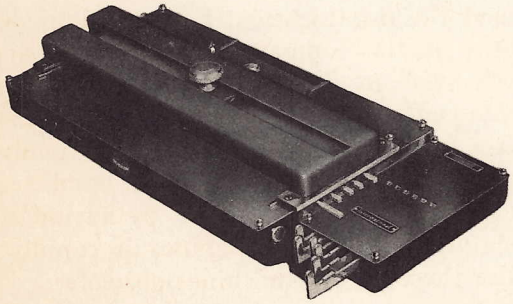
In 1919, for example, electric synchronization, for the control and regulation of complete time and programming systems, was carried to full success and began to win wide commercial adoption. In 1920, came the lock autograph recorder, and in the same year the first complete school time-control system was manufactured. In 1921, the company acquired the business of the Tickettograph Company, of Chicago, and certain patents and other property of the Pierce Accounting

Machine Company, further rounding out and strengthening the service facilities of the IBM line.



Self Supervised Time System

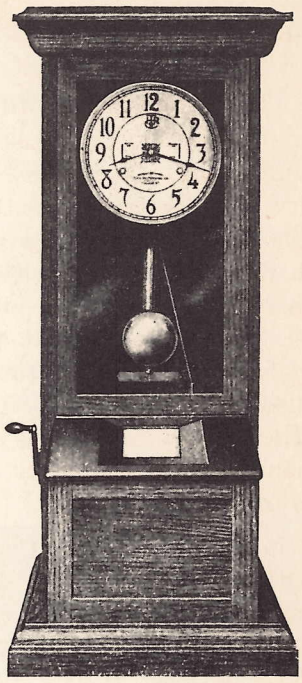
One of the most important, and at the same time thoroughly typical examples of the part played by purely engineering developments in



International Ticketograph

the strength and continued growth of our company is to be found in the story of the printing tabulator. This was in itself one of the most remarkable extensions yet made of the fundamental principles of electric accounting; and it played and is still playing a great part in the constantly increasing use of machine methods throughout the world. It was first placed on the market late in the year 1920.

Prior to the introduction of this machine, the part played by the mechanism in tabulation ended with the appearance of the totals on the counters; they had to be transcribed to the record sheets by hand, which of course brought in human fallibility, manifesting itself sometimes in illegible entries and sometimes in outright errors, besides limiting the speed of the operation to the speed attainable in writing down the correct figures in the correct columns. The new device thus carried forward the speed, economy, and precision only obtainable by purely mechanical operation, through the final stage of the accounting process.

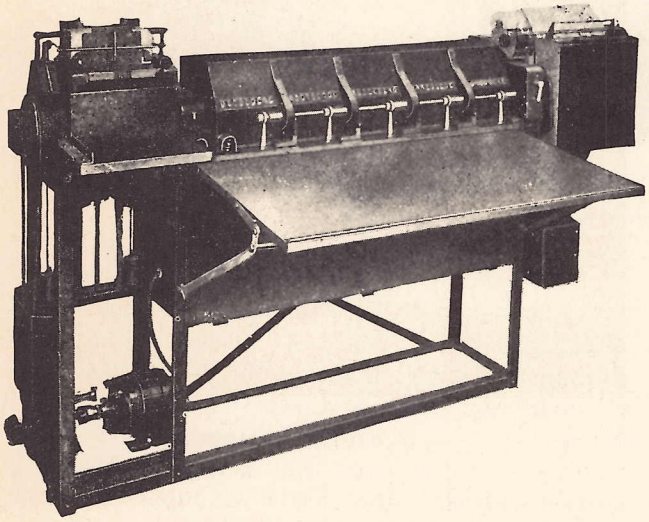


Lock Autograph Recorder

The automatic control system embodied in the printing tabulator had been proposed by Dr. Hollerith; the general scheme of the printing mechanism was worked out by Mr. C. D. Lake. A number of models were produced in 1917 and 1918; the machine as it appeared in 1920 was thus the product of upward of four years' study and experiment; yet even then, by comparison with the improvements still to come, it was far from complete. Not until 1923 can the major problems involved in its successful operation be said to have been definitely solved; nor did the

process of improvement stop there. On the contrary, it has steadily continued, to such a degree that, setting aside later striking new developments such as that of the direct subtraction accounting machine and the alphabetic printing tabulator, it may be said that the printing tabulator of today, while basically identical in design with that of 1923, can perform an immense variety of functions and is being used in a great number of fields which were utterly beyond the reach of the 1923 machine.

All this growth and extension of the company's activities had rendered the old name of Computing Tabulating Recording Company too limited for an organization of such scope; and on February 14, 1924, the name was formally changed to INTERNATIONAL BUSINESS MACHINES CORPORATION.



Type 3 Printing Tabulator

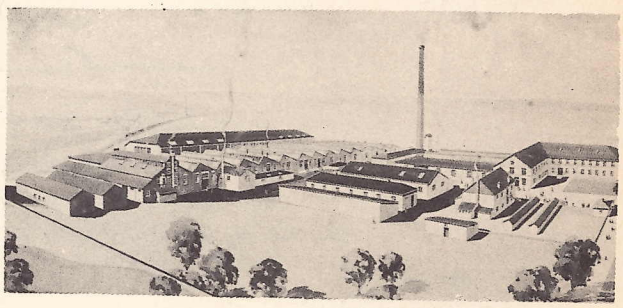
It must be understood that the change from the Computing Tabulating Recording Company of 1911, and even of 1914, to the INTERNATIONAL BUSINESS MACHINES CORPORATION of 1924 far transcended the mere alteration of name. The 1924 company compared with that of 1914 as a ten-year old oak tree compares with a year-old seedling. In mere physical size—in number of employees, size and capacity of factories, number of branch offices and territorial scope of business—it had considerably more than doubled, and was to go on doubling in size and activity on an average of every five or six years.

The company's business has expanded both geographically and functionally; it has entered one country after another until today it has customers in seventy-nine different lands; and it has increased the variety and the sheer volume of its services in all branches of industry and commerce until there is today scarcely a recognized industry or a basic accounting, record-keeping, or statistical function within any important industry, in which IBM equipment is not used.

A few of the more significant dates in these processes of development will give something of a picture of them.

In 1923, the International Business Machines Corporation of Delaware was formed to take over all the company's business in Latin America.

In 1924, the first completely self-regulating impulse time system was installed. In Europe, the company's plant at Sindelfingen, Germany, was completed and commenced operations; the Societe des Balances Automatiques Dayton-Testut was organized in France to carry on the Dayton Scale business in that country.

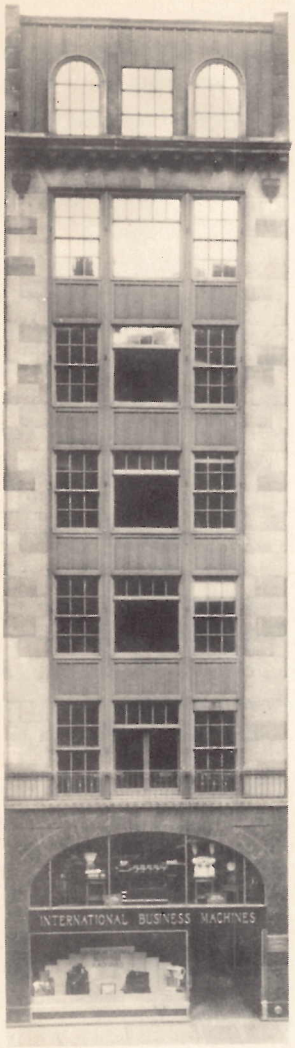


Sindelfingen, Germany

In this year also a seven-story building was completed at 310 Fifth Avenue, New York City, to house the sales and service organizations for that city. One of the most striking of the visible evidences of the growth of our company has been the progress of its offices in the three largest cities of America. In New York, for example, after steadily outgrowing larger and larger office space, sales and service were moved into this large new building; yet in two more years it was necessary to extend still further, and to set up separate offices and show-rooms in Brooklyn.

In Philadelphia, which was once thought adequately served by one combination sales and service man, there is today a large organization completely occupying a handsome modern four-

story building; the story of the development in Chicago has been equally striking and virtually parallel in its scope.



New York Sales Office

One of the most pleasant and also most significant events of 1924 was the first Twenty-Five Year Club Convention, held in Atlantic City, June 21, of that year. This Club consists of employees of twenty-five or more years' service with IBM and one or the other of its parent companies, and membership in it is regarded by all IBM men as one of the highest honors the company offers. Its annual convention may be said to be one of the two "high-lights" of the year for all company employees, and it is invariably made, by Mr. Watson, the occasion for holding up to the entire organization the ideals animating our company as an institution.

The other "high-light" of the IBM calendar—the Hundred Percent Club Convention—was first instituted in 1925. The Hundred Percent Club was also one of Mr. Watson's early inspirations; but prior to 1925 it had only a formal existence; its members received handsome membership pins, but were not actually assembled. In many

Philadelphia Sales Office

respects the Hundred Percent Club Convention has now become the year's greatest occasion for IBM employees generally; its inspirational and educational value has grown year by year, and Mr. Watson signalizes it by some of his most important pronouncements on company policy and progress.

To return to some of the striking date-milestones of IBM progress; in 1925, operations commenced at the company's plant at Vincennes, France. In 1926, two important steps were taken in the company's educational program—of which more will be said later. In this year the first consolidated mechanical service school was opened at Endicott; and in the week of May 22 to 29 were held the first Executives' and Branch Managers' Schools.

In 1927, the development of sales schools took a great stride forward. In that year Mr. Watson authorized a very much wider selection of the

Chicago Sales Office

men who were to take a sales course and simultaneously the course itself was greatly expanded and systematized. As a result, 76 men were graduated in the T. M. Division and 60 in the I. T. R. Division from Sales School No. 51, which was held at the Endicott factory. Ever since that time, the sales training courses have been continually growing in extent and in the thoroughness of the training given.

In 1928, the Type 4 Accounting Machine was placed on the market. This was the first tabulating machine which provided for direct subtraction and also made standard certain improvements previously only included as special devices, permitting a much wider range of computations. The 80-column card and equipment was also placed on the market in 1928.

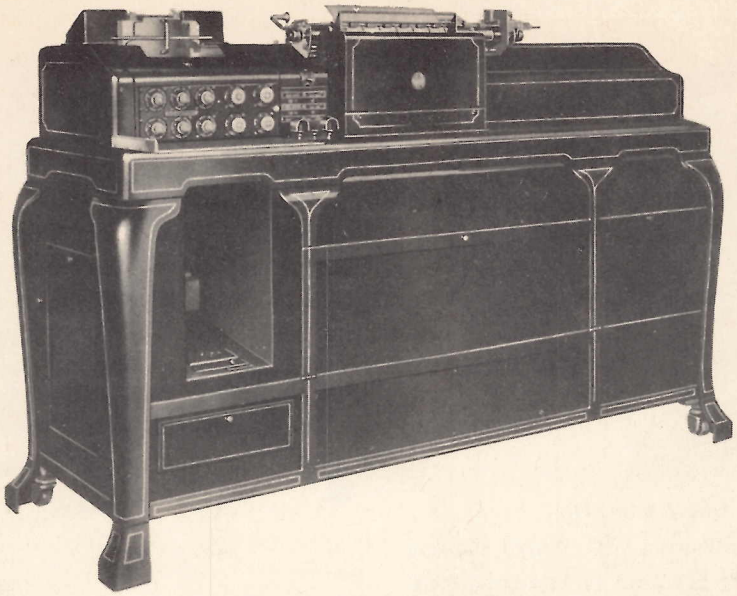
In 1929, the first International public-address system was produced; the Compania Internacional de Maquinas Commerciales, S. A., was organized as the operating company for Mexico. In 1930, the company developed the first complete system of program signalling.

The years 1930 and 1931 were a period of striking progress, particularly in engineering developments. This period was marked by the production of the first automatic summary punch; the multiple-column selecting device, and the card matching device for sorting machines; the automatic electric verifier; and the electric chain-store billing machine, which has opened an immense new field for IBM service.

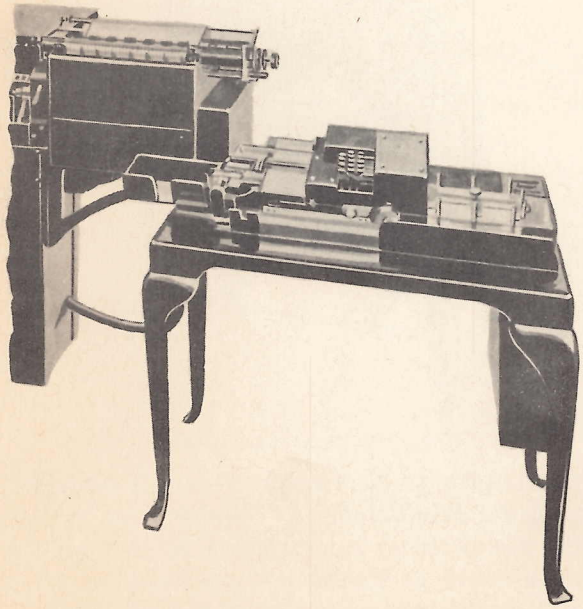
In 1930, appeared one of the most remarkable developments in the age-old business of measuring by weight — the International accounting scale. This device, by the combination of two complete weighing mechanisms in one machine, with apparatus for automatically, mechanically

1924 Hundred Percent Club Convention

and visually computing the ratio between them, instantly counts thousands of small machine parts or pieces; measures the number of yards in bolts of cloth without unwinding; and performs many other similar essential calculations in the taking of inventories, controlling manufacturing processes, etc.



Type 4 Direct Subtraction Accounting Machine

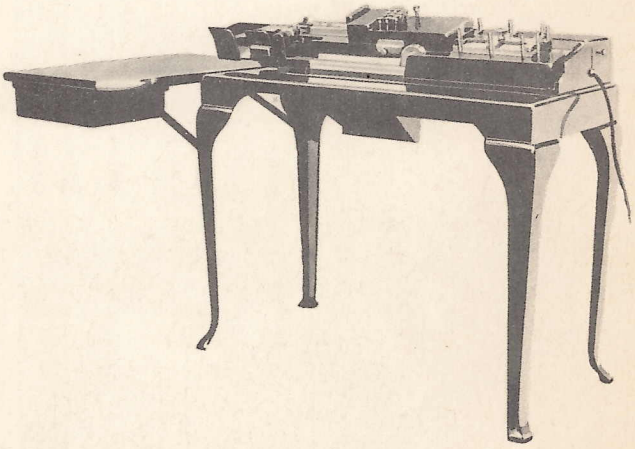


Automatic Summary Punch

In 1931, the first permanent installation of the Filene-Finlay Translator was set up in the Hall of the League of Nations at Geneva.

In 1932, appeared the counting sorter, check-writing interpreter, the first alphabetic tabulating equipment, the multiplying punch, and the Cosmograph.

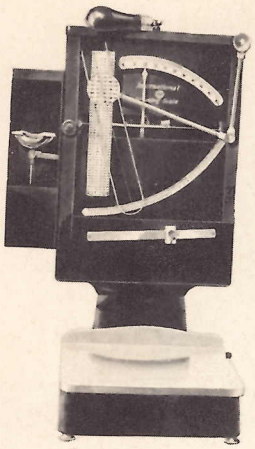
Finally, in 1933, we have seen the development of the alphabetic printing punch and direct-subtraction accounting machine, the automatic re-



Automatic Electric Verifier

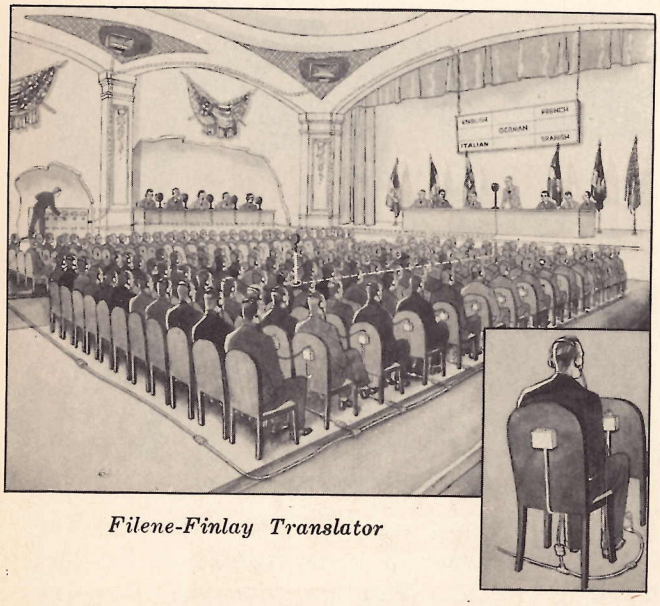
producing punch, and the proof machine for banks. But probably more important, for our company's future, than any single step of recent years, was the completion in that year of the new Engineering Laboratory, and the IBM School Building at Endicott. In Europe, the new Berlin plant of the company was formally opened in December.

Something has already been said regarding the consistent fostering by President Watson of engineering, research and development work, which has kept IBM service far in the lead in its



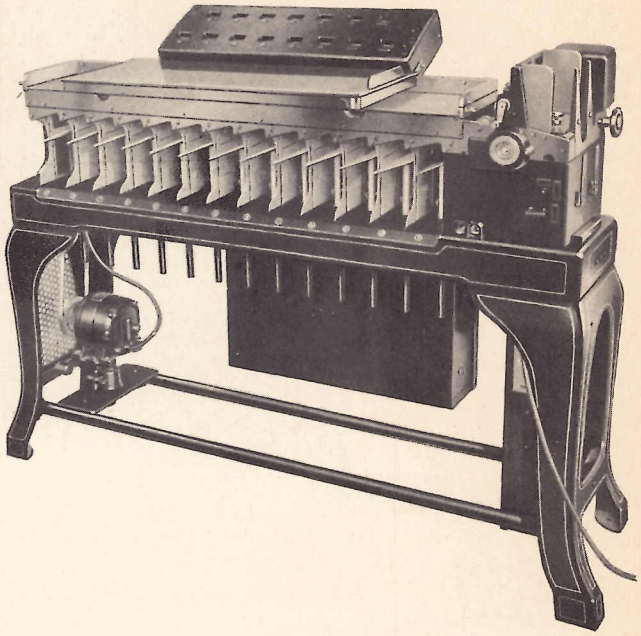
International Accounting Scale

field. This policy culminated, in 1932, in the organization of a major division of the company to assume full charge of this work for the entire IBM line, and the construction of one of the finest and most completely-equipped modern laboratories of its type in the world, in which research and invention can be carried on under the most favorable conditions possible.

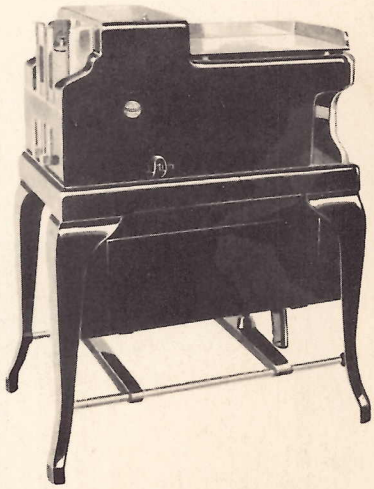


Filene-Finlay Translator

Not so much has been said of another of the company's activities at least equally important in President Watson's eyes—its twenty-year development of an educational program for the benefit of its men. The slogan in this field has been, "If you want a business to grow, grow men"; and it has been consistently followed both in letter and in spirit. Education has been given official consideration as an important



Counting Sorter



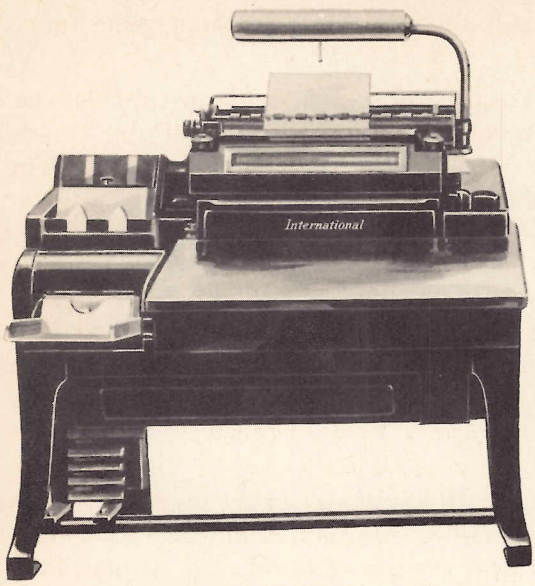
Check Writing Interpreter

company activity through the formal organization of the Educational Department on May 1, 1932. No business organization in the country offers a more complete and practical program for aiding its employees in self-betterment; and the School Building is considered to be the finest modern structure of its type, devoted wholly to the education and training of company employees, in the world today.

IBM Schoolhouse

IBM Engineering Laboratory

The autumn of 1933 also saw the addition of an entirely new product division to IBM—the

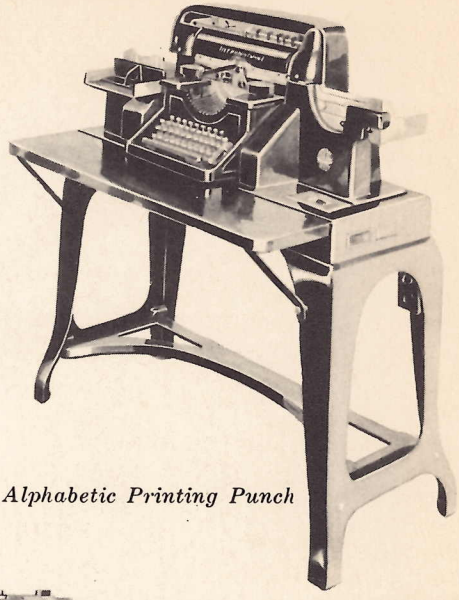


Alphabetic Tabulator

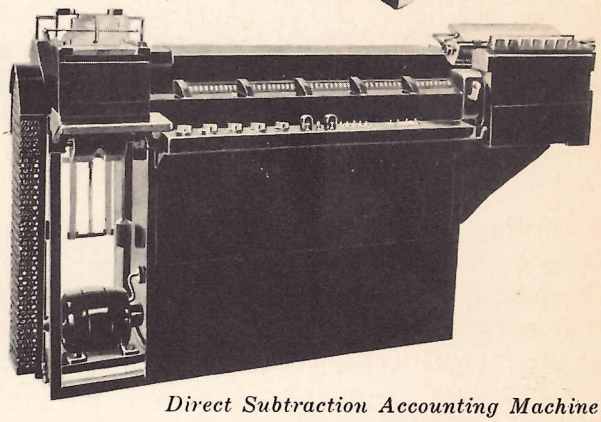
Multiplying Punch

Electromatic Typewriters Division, whose machines, no less than those of the pioneer divisions, embody the principle of speed, economy, and precision in the service of business.

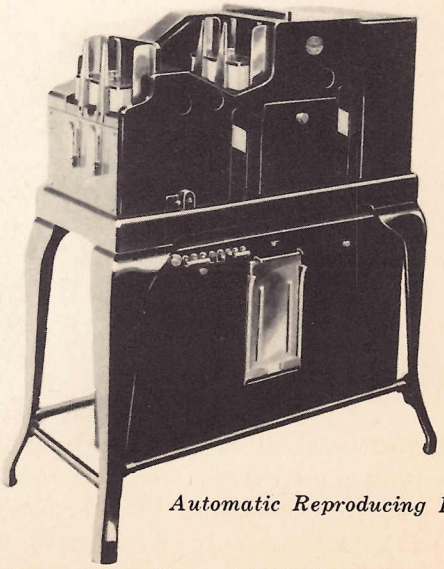
The field of IBM was still further clarified by an important step taken in the summer of 1934. It had for some time been evident to Mr. Watson that there was a natural cleavage in the scale business of the Company—between the scales and other equipment used only in retail stores, and the computing and other scales used in manufacturing and other business. His decision was



Alphabetic Printing Punch



Direct Subtraction Accounting Machine



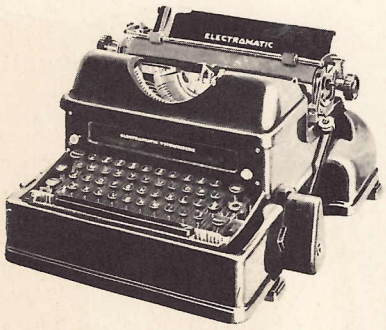
Automatic Reproducing Punch

to withdraw from the retail field and to concen-

trate along the natural lines of the Company's development, in service to industry generally.

Proof Machine for Banks

Accordingly, the business of the Dayton Scale Division was sold to the Hobart Manufacturing Company, while at the same time increased attention was given to the development of the business of the International Scale Division.



Electromatic Typewriter

OUR COMPANY TODAY

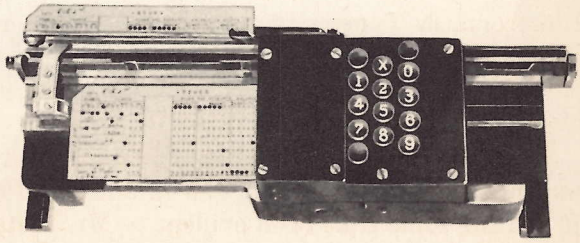
INTERNATIONAL BUSINESS MACHINES CORPORATION is an enterprise on which the sun literally never sets. Its products and its service reach to the world's farthest outposts of commerce and industry. Wherever men create and build, International machines are known, used, and trusted. They help to solve the problems and lighten the tasks of business in every civilized country of the world—and in some in which civilization itself is still scarcely more than struggling for a foothold.

To serve this world-wide institution, the company owns and operates, directly or through its subsidiaries, factories in eight cities in five countries; three in the United States—its principal plant at Endicott, New York; a card-printing plant at Washington, D. C.; the Electromatic Typewriter factory at Rochester, New York; one at Toronto, Canada; one at Hammersmith, near London, England; and the plants at Sindelfingen and Berlin, Germany, and at Vincennes, near Paris, France.

The world-wide scope of IBM service geographically is matched by its functional scope. Its ramifications in virtually every field of industry and commerce could only be adequately described in several volumes—and its applications are being extended so rapidly and steadily that by the time they could be printed, those volumes would already be out of date. But some idea of the extent and variety of our service can be given by a brief list of the more important individual devices manufactured and distributed by INTERNATIONAL BUSINESS MACHINES CORPORATION, listed by divisions, with explanations of the leading items which have not already been explained in their historical order.

1. *Tabulating Machine Division*

This division distributes today's various highly developed forms of the basic three machines for electric accounting—punch, sorter, and tabulator. Among them are mechanical and electric key punches, multiplying punches, summary punches, reproducing punches, verifiers, gang



Electric Key Punch

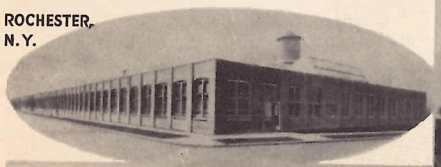
punches, alphabetic punches; electric record sorting machines, counting sorters and counting

INTERNATIONAL FACTORIES

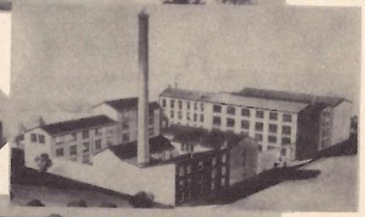
ENDICOTT, N.Y.

TORONTO, CANADA

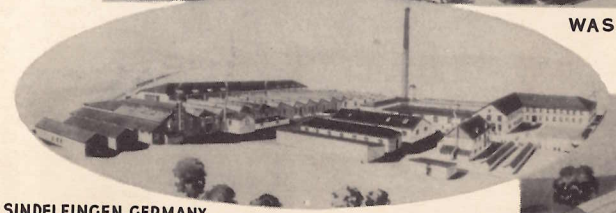
WASHINGTON, D. C.



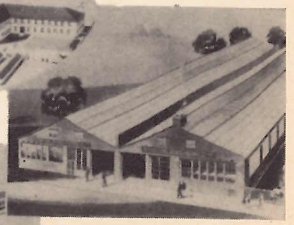
ROCHESTER, N.Y.



PARIS, FRANCE

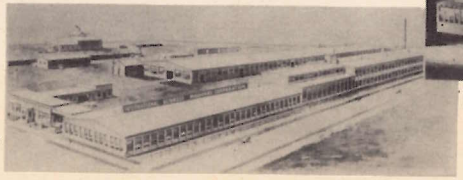


SINDELFINGEN, GERMANY



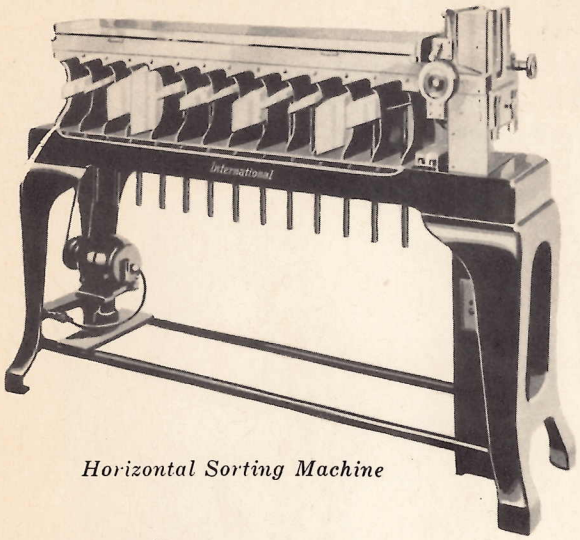
LONDON, ENGLAND

BERLIN, GERMANY

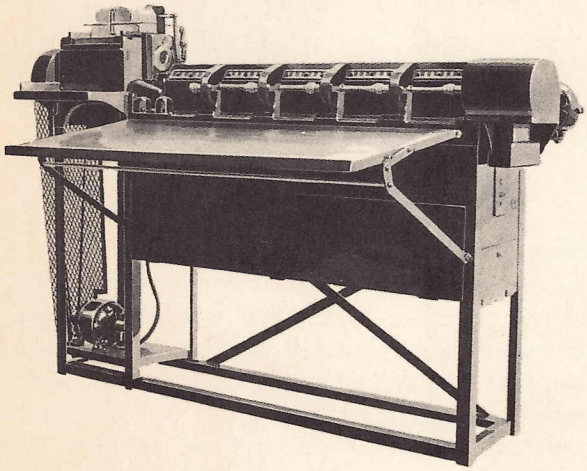


DAYTON, OHIO

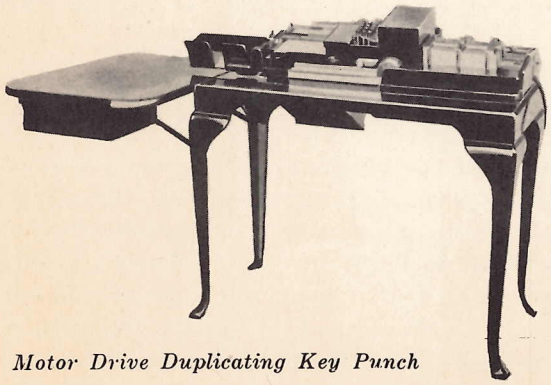
and printing sorters; electric tabulators and accounting machines, automatic bill-feed tabulators, invoicing tabulators, alphabetic accounting



Horizontal Sorting Machine



Automatic Control Tabulator

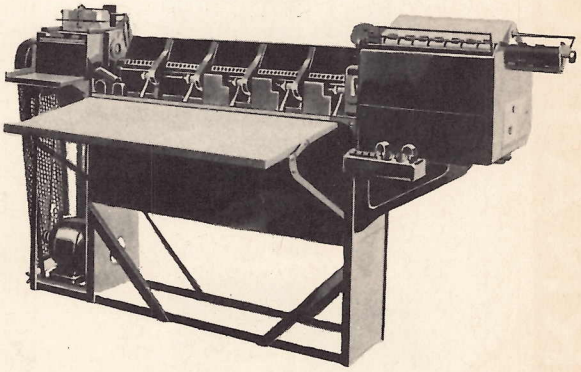


Motor Drive Duplicating Key Punch

machines, automatic checking machines, interpreters, and combination printing tabulators and automatic summary punches.

The Tabulating Machine Division also distributes the International Cosmograph, a device for producing graphic analyses of business facts expressed in figures, without the necessity for actually drawing graphs. The finished Cosmo-

Motor Drive Gang Punch

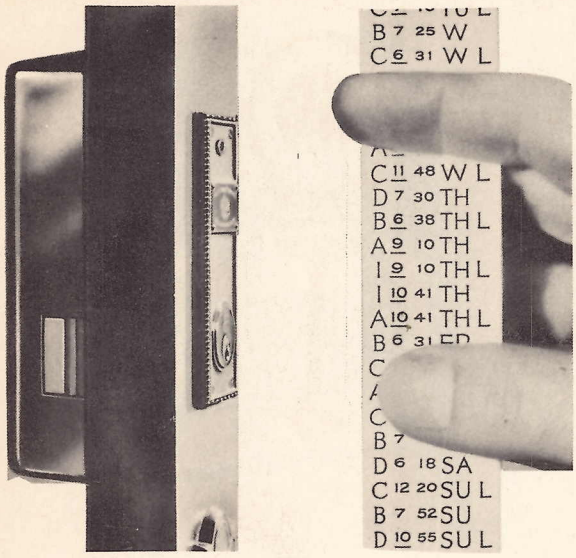


Electric Accounting Machine

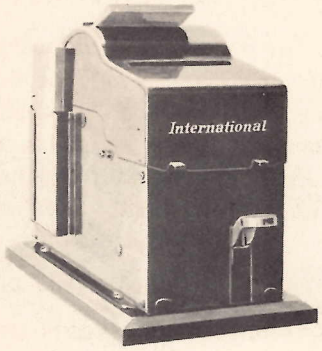
graph chart not only has all the advantages of the drawn graph, but can be produced much more quickly, and with a degree of accuracy seldom attained in drawn presentations. It is applicable to any problem whose solution requires visualizing figure-facts in their relation to each other.

2. *International Time Recording Division*

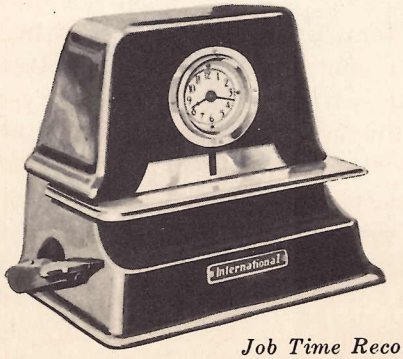
This division distributes and installs electric time systems, attendance time recorders, payroll dial recorders, job time and cost recorders, time stamps, program signal devices, door recorders, watchmen's systems, interior telephone systems, central control radio, music, and speech equipment, and laboratory panels.



Recordolock



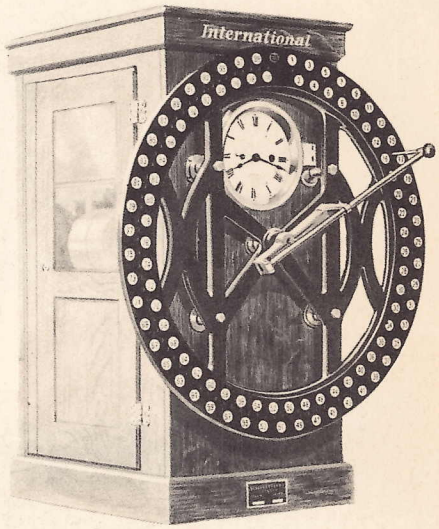
Money Time Recorder



Job Time Recorder

The highest development today in accurate indicating, signalling, and recording of time for any working purpose is embodied in the International Electric Hourly-Supervised Time System.

This system is an exclusive feature of International time recorders and time-indicating and signalling devices, and accomplished for the first time in the history of the time-keeping art the synchronizing at any desired number of mechanisms of whatever type, so that each time or job recorder, time stamp, secondary clock, tower clock, or other time unit, wherever placed, is automatically regulated each and every hour by the master clock or regulator, and kept in exact agreement with all other time units of the system. It furnishes efficient and flexible electric program control which automatically operates any desired schedule—no matter how complicated—of bell, buzzer, horn, or whistle signals.

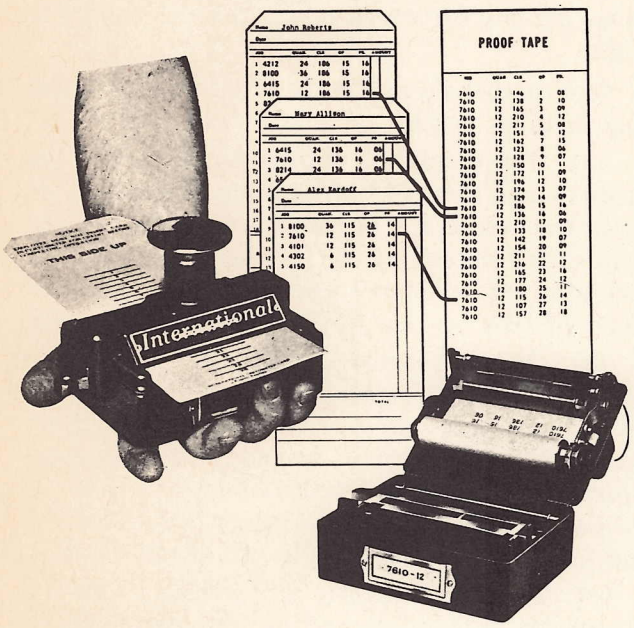


Automatic Payroll Machine

3. *International Ticketograph Division*

The Ticketograph was the first machine developed for printing section work tickets for use in preparing pay-rolls and for recording and pricing the progress of work through a department or plant. Its use eliminates a great deal of clerical work and so not only cuts down the expense of this type of record-keeping, but by its automatic operation cuts down the risk of errors and discrepancies. It prints coupons, indelibly, with specially designed type to guard against alterations.

The Certometer effects similar control but applies to a different method of management, in that the records are kept on a daily production ticket, on which each entry made by the Certometer constitutes a pay voucher for a particular job. With the Ticketograph, each complete ticket furnishes pay vouchers for all operations on one job and each operator detaches and retains that coupon corresponding to his part of the work.



Certometer

At the time of the acquisition of the Ticketograph business, the marketing of the Ticketograph was given over to the International Time Recording Division because the machine was used in the preparation of pay-rolls. Later, because of the fact that the Ticketograph system carries beyond the point of making original records into the accounting work proper, the Ticketograph was classed as an accounting machine and its distribution was assigned to the Tabulating Machine Division.

Engineering developments in the machine itself, expansion in its field of application, and the development of new products necessitated the establishment of a separate division in 1934 to carry on the distribution of these products.

4. *International Scale Division*

This division distributes types of scales especially designed and adapted to weighing—and measuring by weight—all types and kinds of industrial materials. Its line of scales ranges from the smaller types, which are sensitive and accurate to as little as one gram, up to and including platform scales capable of weighing with speed and accuracy masses running into tons. It includes many types of scales designed for special purposes, such as counting scales; special percentage scales used in the silk industry; special

International Portable Scale

yield scales for the rayon industry; overhead track scales for packing houses; and many others —each giving, in its specific task, the maximum speed and accuracy obtained from any mechanism today in measuring, testing, checking, compounding, and classifying the materials of industry.

5. *Electromatic Typewriters Division*

This division manufactures typewriting equipment, covering the entire field of typewriter application from the individual machine to complete automatic operation and distant control either of single machines or a battery of machines, by wire connection or radio control—although this last development is still, at the time this is written, in the experimental state.

The individual electromatic typewriter represents as great an advance over the finest modern mechanically operated typewriters, as those machines do over the best machines of twenty-five or thirty years ago. By substituting electric and automatic operation for all steps in typing procedure—not only actual printing, but carriage

return, shift control, etc.,—previously requiring manual labor, it has advanced typing speed by at least 25 to 30% (depending upon the skill of the operator) and at the same time almost eliminated muscular fatigue and greatly cut down the percentage of error. It also permits the making of two or three times as many legible carbon copies in a single operation, as is possible with a manually operated machine.

Electromatic Typewriter

This same remarkable machine can be equipped for automatic reproduction, at high speed, of as many copies as are desired of a master document. The same reproducing mechanism may be made to actuate—at any distance and at any point—as many machines as desired. For example, a message or letter typed on the control machine in New York may be simultaneously typed on machines in Endicott, Washington, Dayton, or any other connected point; and the control machine may be operated automatically to turn out, in each of these places, any desired number of copies of any document—for example, a sales letter. Radio control, extending this application virtually world-wide, has been proved to be practicable; its development waits only on the solution of certain problems of technical detail.

INTERNATIONAL BUSINESS MACHINES CORPORATION—ITS FUTURE

The statement was made early in this lesson that the undeveloped field for IBM service today is actually greater compared with our present total business than was that open to the three parent companies in the early years of their development.

This statement is not only true but is of such great importance and value to every IBM employee that it can not be too often emphasized. IT SHOULD NEVER FOR ONE MOMENT BE FORGOTTEN. It is not only true in general; it is true in detail—there is not one mechanism or device out of over 600 in the IBM line whose potential market is even approaching saturation; not one for which saturation is remotely in sight.

Our company's market, and its task, is growing in three ways.

(a) The formation of new business, and the growth and merging of existing businesses, all over the world are constantly creating entirely new situations calling for IBM services—actually bringing into existence needs for one or another form of IBM service (often for several at once).

(b) Our own experience, and that of our present customers, is constantly developing new applications—new uses for our present machines, new and better ways of applying them to some specific task, which immediately open for us wholly new fields of opportunity we either did not know existed, or thought out of our reach.

(c) We are constantly discovering needs for the speedy, economical, and accurate organization of business facts along different lines from any with which we have had previous experience—needs highly specialized in character which are yet common to whole industries of great proportions—which none of our present machines can fully meet. But we find that a new machine, or new attachment to or modification of an existing machine, can be devised to meet it. And this opens still another wholly new market to us—one that did not, in the literal sense, even exist before. It practically always happens, too, that this new machine or device immediately proves to have much wider uses than the specific one for which it was designed; so it in turn opens still other fields, sometimes actually greater than that which first inspired it.

Now consider these three processes of growth—all three of which you have already seen exemplified throughout the entire history of our company as you have just studied it, and all three of which are going on today at a still more rapid

rate than ever before—in connection with one definite fact. That fact is, that according to the best information we can obtain, in the United States—the nation which has far outstripped every other in the world in the use of machine methods—today not over 5% of all accounting and statistical work is being done by such methods.

Query: If in the nation which leads the world in mechanical development and organization 95% of our market as it exists today is still untouched by us—

and if this market, huge as it is, is growing in three ways and many times three directions, often actually faster than our utmost efforts to pursue it, and *at an increasing rate*—

what do you consider a conservative estimate of the possibilities of future growth of INTERNATIONAL BUSINESS MACHINES CORPORATION?

Consider also this fact.

The value—more than the value; the indispensability—of IBM service in large-scale business operations the world around has today been so thoroughly demonstrated that no *external* event short of a virtual world-wide collapse of civilization could possibly halt our company's progress. Yet this task of introduction and demonstration, as it has been performed, is only preliminary to the real task of market development still ahead.

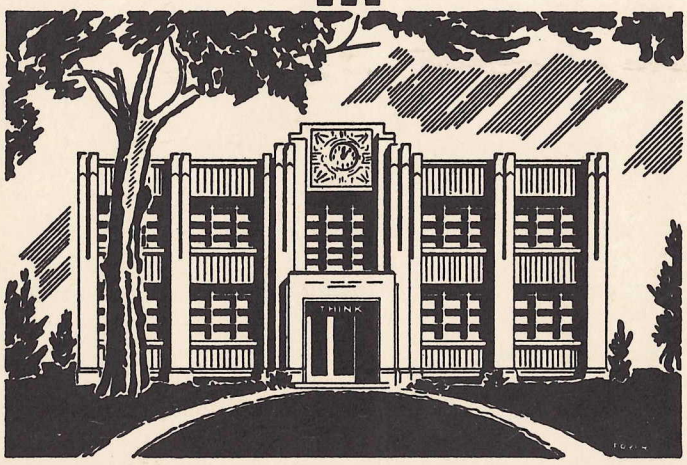
No *external* event can halt us. The one possible obstacle to progress on a far greater scale than any yet realized is *internal*—the development of either a complacent or a defeatist attitude on our own part; either an utterly uncalled-for idea that we have attained a momentum which can carry us forward with something less than the utmost effort of which we are capable; or an equally, utterly fallacious notion in defiance of overwhelming evidence to the contrary, that this enormous, world-wide and still growing undeveloped market and need for our services does not really exist.

It is because of this—our only danger—that every IBM employee owes it as his first duty to his company and his own future to know his own company so well that he sees it at all times as it really is, as it has been and as it will be; to convince himself by personal investigation and study, if he still needs convincing, that its greatest tasks and its greatest achievements still lie ahead; that its whole past history and present position are in themselves irrefutable proofs and unbreakable pledges that those tasks will be triumphantly performed—those achievements triumphantly won.

BUSINESS
INTERNATIONAL
MACHINES

THE PURPOSE OF AND FIELD FOR TABULATING MACHINES

LESSON NO. 2



MANUAL OF INSTRUCTION

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

ENDICOTT, N. Y.

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FORM 2—2

THE PURPOSE OF AND FIELD FOR TABULATING MACHINES

The industrial revolution which took place in the 19th century, establishing the machine for all time as the logical means of speeding up production to meet the demands of consumption and produce goods in relation to pocketbook, was a historical analogy of what is happening in the office today.

This is the day of revolutionizing office procedure by mechanizing it generally. The pen, high stool, bound ledgers, and long hours are gone. The machine has freed the clerk of today from drudgery and enabled him to use his reasoning powers rather than to spend his energy in routine work.

Mechanization of Business

This trend toward the business machine has been the logical outcome of the tendency of business. A century ago industries were small, production was limited, and the business was usually owned and operated by the same man or family for years. He knew the plant, the business, the field, and all the facts concerning it. His requirements of additional facts were small and his knowledge of the science of business was meagre.

With machinery came increase of production and consumption, - with this came the need for money for expansion; with development of business came the need for compiling figure-facts for the joint owners, and the need for facts which would increase profits and eliminate waste from business.

What is more natural or logical than that the business man should ask for office machines which would keep pace with his factory machines. The office equipment manufacturers responded to the call and today the office is arriving at the point where it can keep pace with the factory.

The factory can easily enough turn out the goods but the office must have the materials on hand with which the factory works, - the office must tell the

factory what will be consumed; - the office must collect the money for the goods and direct the forces in the effective distribution of these goods; - the office must reimburse the men for producing the goods and the vendor for selling the raw material; - the office must tell the executives what this endless chain is accomplishing so that this astounding maze of detail can be brought into an array of accurate, timely, condensed reports to shape the policies of the company.

Purpose of Tabulating Machines

Electric Tabulating and Accounting Machines permit the use of science in business. They make possible an analytical review of operating factors from various angles, whether the business be of a manufacturing, distributing, or service nature. Wrong tendencies can be localized and rectified before they have an opportunity to progress to a point which will result in an unknown but continuous loss to the business.

The repeated use of the same set of figures analyzed from different angles assures complete and detailed knowledge. If deficient tendencies or conditions exist, if only general data are secured, these tendencies would not be detected.

The use of net results based on limited details is dangerous since with the increase in the operations of a business, the deficiencies, which may grow slowly over a period of years, will result in a steady but certain loss. This will not be known or realized until the volume becomes so large that it will offset or materially decrease the factors which have created additional profits. It will be more difficult to adjust and rectify the wrong conditions that have existed over a period of years, but were not apparent, due to the limited amount of information available with which to study the progress of the business.

The use of Electric Tabulating and Accounting Machines assists in preventing conditions of this nature. Tabulating cards store information for current

use or for future study and permit arriving at intelligent decisions based on known factors. The cards containing the records of transactions for preceding periods can be readily sorted and analyzed to reflect the results which would have been obtained during past periods had proposed changes in policy been in effect at that time.

Field for Tabulating Machines

Effective reports are the compass of Industry. They indicate the trend of activities. To collect and analyze figure-facts is therefore one of Industry's most important tasks.

Inasmuch as the usefulness of reports is dependent upon their accuracy and timeliness, it is essential that the contributing data be dependably correct and capable of speedy tabulation.

An economical process for analyzing every phase of accounting work, such as disbursements, labor, material, and other accounting or statistical factors, is an important instrument in the hands of a business organization. If the same figures can at any time be reanalyzed from different points of view, the value of the process is greatly increased.

The Electric Tabulating and Accounting Machine Method provides the medium through which this maximum use of figures can be obtained quickly and economically, without necessitating a change in the routine of existing accounting methods.

The Electric Tabulating and Accounting Machine Method is recognized by all industries as the quickest and most dependable means of analyzing such facts as develop in the everyday operation of a manufacturing, mercantile, insurance, transportation, governmental, or other business.

THE MANUFACTURE AND USE OF TABULATING CARDS

MANUAL OF INSTRUCTION
LESSON NO. 3

INTERNATIONAL BUSINESS MACHINES CORPORATION
270 BROADWAY, NEW YORK, N. Y.

THE MANUFACTURE AND USE OF TABULATING CARDS

The tabulating card is the basic unit in accounting and statistical analysis. It is the medium which actuates the various machines and plays a part which is as essential and important as that of the punch, the sorter, and the tabulator. Care in the manufacture of the card must be governed by the same standards of precision which characterize every step in the manufacture, assembly, and inspection of the machines themselves.

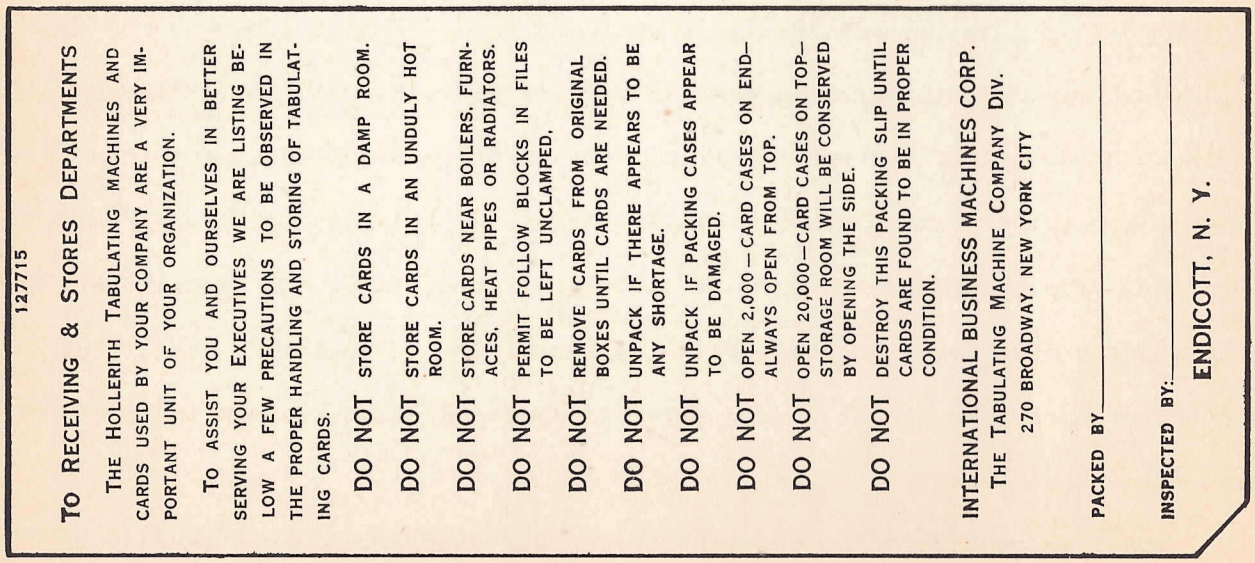
Tabulating cards are manufactured from a special high grade paper stock which is especially prepared for our use. Every care is taken to produce a paper of strong wearing quality and free from foreign particles which might act as a conductor of electricity. The large rolls of paper are shipped in carefully lined freight cars to avoid any injury to the paper stock in its transportation from the paper mills to our factories.

After the rolls of paper are unloaded from the freight cars, they are stored for several months before being converted into tabulating cards. The first step in our own plant is the examination of the paper stock by the speck detector, to insure the finished tabulating card from containing carbon spots, slime spots, minute perforations, or other inferiorities which would make the card a conductor of electricity. The card stock must be absolutely free of foreign particles so that tabulating machines will be actuated only by the holes which have been punched in the cards. Special knives cut the paper for a distance of about 16 inches at any point at which an electrical contact is made, thus permanently marking the stock and preventing its use by customers.

When the stock has been checked by this test, it is cut by slitting knives into strips 3¼" wide and wound on reels. These reels are then stored in felt-lined racks which prevents damages to the edges until the cards themselves are to be printed. The printing operation is unique. The Carroll presses which are

used to prepare practically all tabulating cards are the fastest machines of their type ever built. Approximately 460 cards per minute are printed and cut on this machine. The length of a standard tabulating card is 7-3/8" with a maximum variation of .005 of an inch. The preciseness of the dimensions of the tabulating card is absolutely essential to guarantee their accurate functioning in tabulating machines.

As the cards are taken from the stacker of the press, they are examined by an inspector, who checks the printing, the accuracy of the dimensions, the alignment of the card, and the quantity. The cards are then packed in boxes containing either 2,000 or 20,000 cards. The larger cases are specially lined with waxed paper to prevent deterioration of the cards due to atmospheric conditions during transportation or storage in customers' cellars and stock rooms.. A tabulating card, containing the following list of instructions, is placed in each box of cards to advise users of proper care and handling:



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TO RECEIVING & STORES DEPARTMENTS

THE HOLLERITH TABULATING MACHINES AND CARDS USED BY YOUR COMPANY ARE A VERY IMPORTANT UNIT OF YOUR ORGANIZATION.

TO ASSIST YOU AND OURSELVES IN BETTER SERVING YOUR EXECUTIVES WE ARE LISTING BELOW A FEW PRECAUTIONS TO BE OBSERVED IN THE PROPER HANDLING AND STORING OF TABULATING CARDS.

DO NOT STORE CARDS IN A DAMP ROOM.

DO NOT STORE CARDS IN AN UNDULY HOT ROOM.

DO NOT STORE CARDS NEAR BOILERS, FURNACES, HEAT PIPES OR RADIATORS.

DO NOT PERMIT FOLLOW BLOCKS IN FILES TO BE LEFT UNCLAMPED.

DO NOT REMOVE CARDS FROM ORIGINAL BOXES UNTIL CARDS ARE NEEDED.

DO NOT UNPACK IF THERE APPEARS TO BE ANY SHORTAGE.

DO NOT UNPACK IF PACKING CASES APPEAR TO BE DAMAGED.

DO NOT OPEN 2,000—CARD CASES ON END—ALWAYS OPEN FROM TOP.

DO NOT OPEN 20,000—CARD CASES ON TOP—STORAGE ROOM WILL BE CONSERVED BY OPENING THE SIDE.

DO NOT DESTROY THIS PACKING SLIP UNTIL CARDS ARE FOUND TO BE IN PROPER CONDITION.

INTERNATIONAL BUSINESS MACHINES CORP.
THE TABULATING MACHINE COMPANY DIV.
270 BROADWAY. NEW YORK CITY

PACKED BY_____

INSPECTED BY:_____

ENDICOTT, N. Y.

THE USE OF TABULATING CARDS

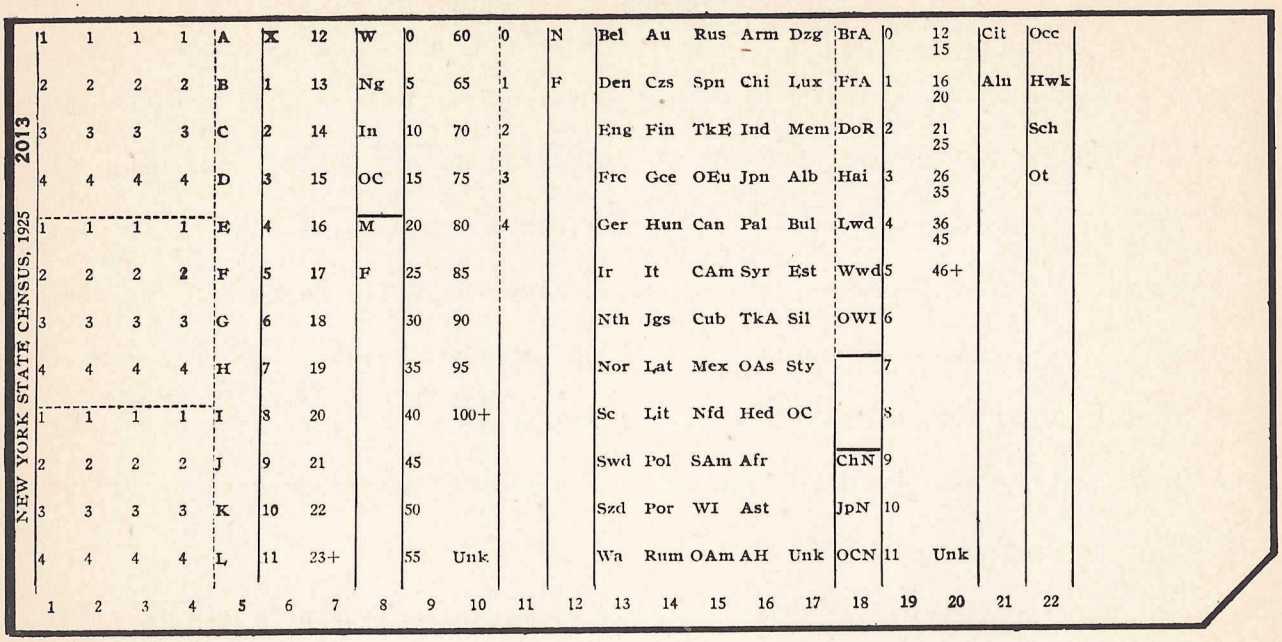
The tabulating card, which was first devised by Doctor Hollerith and adapted to the United States census, is called a unit record. For sales accounting, the card represents a single item on an invoice; in payroll, a single unit of work performed by a single workman; in accounts receivable, it represents a single amount of indebtedness as covered by an invoice or a single item representing the liquidation of indebtedness such as a check or cash received from a customer; and in census studies, each card records the status of an individual as to age, nativity, marriage, occupation, etc.

The purpose of creating a unit card is to establish a single simple record of a transaction or condition, which may be sorted and re-sorted by means of automatic machines for the preparation of various analyses and reports on the electric accounting machines. Doctor Hollerith himself defined the tabulating machine as "a means of automatically cross-indexing information."

The Census

The United States census, which is taken every ten years, is in its present form an outgrowth of the work of Doctor Hollerith in the census of 1890. The same basic principles which were applied then are still applicable. After the original data regarding the various individuals comprising the inhabitants of the country have been recorded by the census takers, a tabulating card, similar to the one shown on the following page, is prepared which becomes the basis of all subsequent analyses.

The time required for preparing the census tabulation is continually being reduced by means of newer and more automatic equipment, in spite of the constantly increasing number of people concerning whom data must be recorded and analyzed. The census of 1880, which was the last one to be prepared on a com-


NEW YORK STATE CENSUS, 1925 2013
1 1 1 1 A X 12 W 0 60 0 N Bel Au Rus Arm Dzg BrA 0 12 15 Cit Occ
2 2 2 2 B 1 13 Ng 5 65 1 F Den Czs Spn Chi Lux FrA 1 16 20 Aln Hwk
3 3 3 3 C 2 14 In 10 70 2 Eng Fin TkE Ind Mem DoR 2 21 25 Sch
4 4 4 4 D 3 15 OC 15 75 3 Frc Gce OEu Jpn Alb Hai 3 26 35 Ot
1 1 1 1 E 4 16 M 20 80 4 Ger Hun Can Pal Bul Lwd 4 36 45
2 2 2 2 F 5 17 F 25 85 Ir It CAm Syr Est Wwd 5 46+
3 3 3 3 G 6 18 30 90 Nth Jgs Cub TkA Sil OWI 6
4 4 4 4 H 7 19 35 95 Nor Lat Mex OAs Sty 7
1 1 1 1 I 8 20 40 100+ Sc Lit Nfd Hed OC 8
2 2 2 2 J 9 21 45 Swd Pol SAm Afr ChN 9
3 3 3 3 K 10 22 50 Szd Por WI Ast JpN 10
4 4 4 4 L 11 23+ 55 Unk Wa Rum OAm AH Unk OCN 11 Unk
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

pletely manual basis, required 7½ years for completion and indicated the futility of the methods then in use. The first census prepared by the use of tabulating machines was completed in about 2½ years. The census of 1930 was completed in less than two years.

Remarks

The story of the manufacture of the tabulating card and of the preparation of the United States census is presented in the form of moving pictures.

TABULATING CARD DESIGN 4

MANUAL OF INSTRUCTION LESSON NO.

INTERNATIONAL BUSINESS MACHINES CORPORATION
270 BROADWAY, NEW YORK, N. Y.

Form 2-17-1

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By
INTERNATIONAL BUSINESS MACHINES CORPORATION
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TABULATING CARD DESIGN

The tabulating card is the basic instrument of the Electric Tabulating and Accounting Machine Method. It affects to a large degree all procedures utilizing this method.

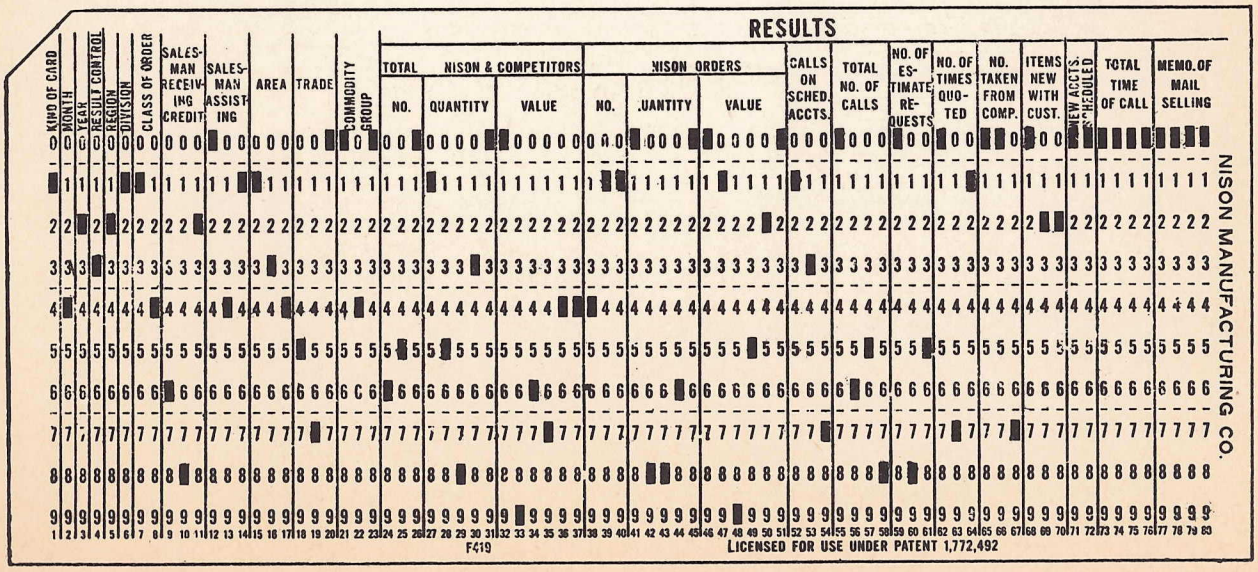
The design of the card is one of the most important factors in determining the efficiency of the plan, the availability of information, and the speed of obtaining reports. The success or failure of an installation may be dependent upon the accuracy and suitability of card design.

Tabulating cards may be divided into general types according to the purposes which they serve and according to their form. These types are explained below.

Particular attention should be given to the terms which are used to describe the various types of cards. It is highly desirable that this uniform terminology be established in order that confusion may be prevented in the minds of tabulating machine users and Tabulating Machine Company representatives.

Transcript Cards

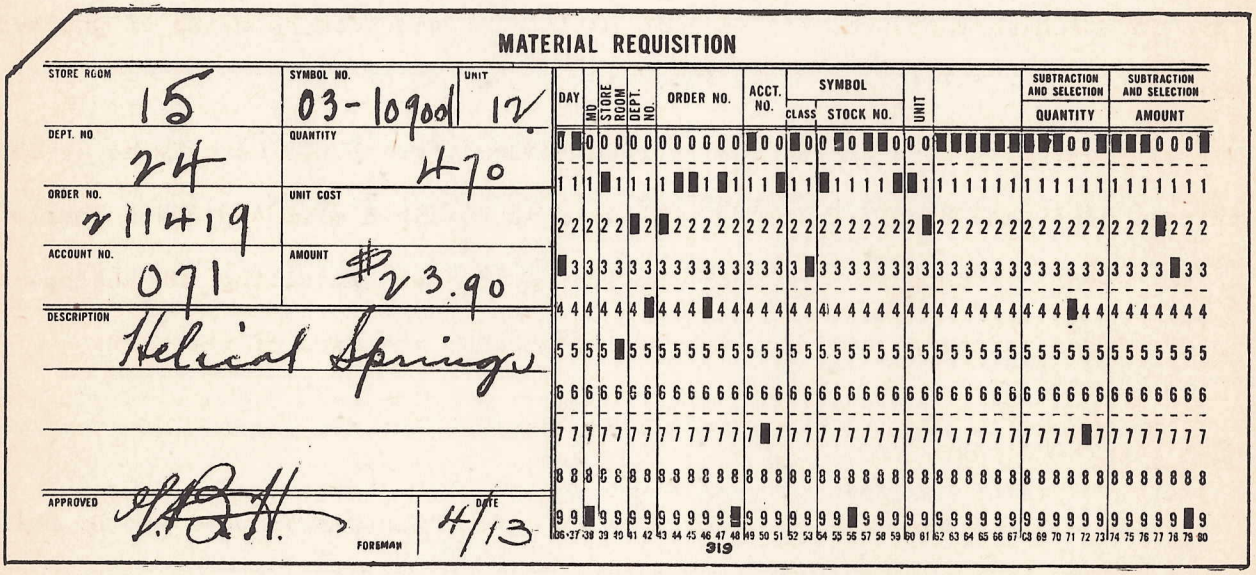
This term is applied to all tabulating cards which are punched from information previously recorded on some other record. When manually-fed punches are



to be used, transcript cards should be so designed that if the information to be punched does not require the entire card, the punched fields are located at the right end of the card and the unused columns at the left. When automatically-fed punches or duplicating punches are used, any unused columns may be at either the right or the left end of the card.

Dual Cards

A "dual" card is one which serves the double function of providing space for the original information as well as fields to which this information may be transcribed by punched holes. This dual arrangement is effective in increasing punch production, in eliminating subsequent reference to a source record, and in making the card more readable.



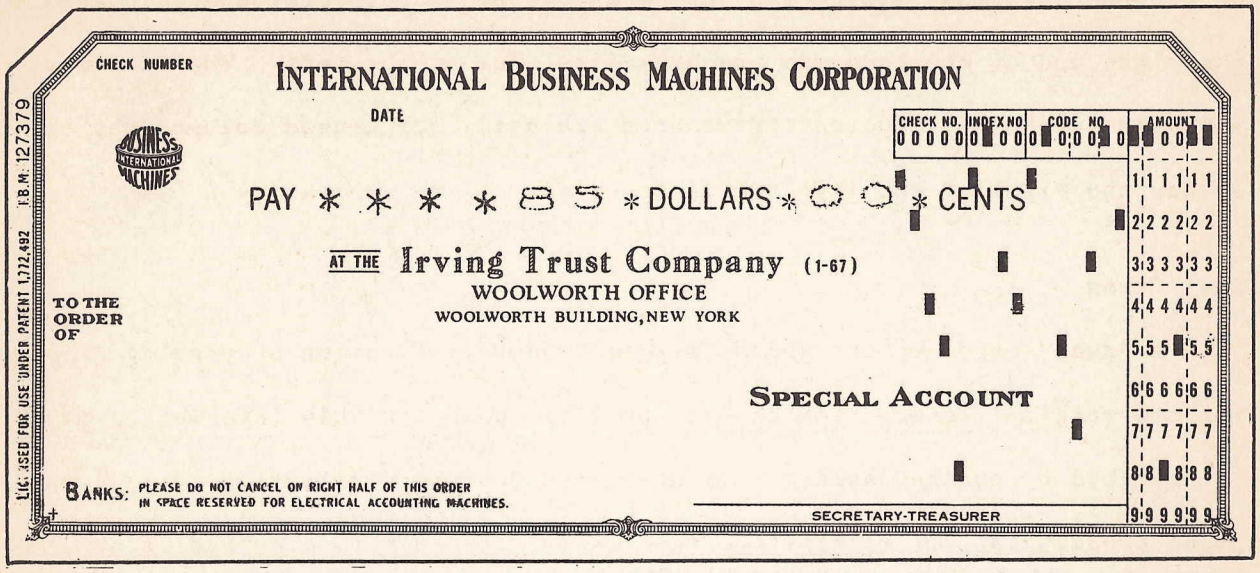
Dual cards in general should be designed with the space for writing to the left so that when a card is positioned in the punch, the written information is visible to the operator.

In general all cards are either Transcript or Dual. A description of the subdivisions of either class follows.

Card Checks

Tabulating Card Checks are considered as a separate class on account of

their specialized function. In type they are an illustration of a dual card,


CHECK NUMBER
INTERNATIONAL BUSINESS MACHINES CORPORATION
DATE
CHECK NO. INDEX NO. CODE NO. AMOUNT
PAY * * * * 85 * DOLLARS * 00 * CENTS
AT THE Irving Trust Company (1-67)
WOOLWORTH OFFICE
WOOLWORTH BUILDING, NEW YORK
TO THE ORDER OF
SPECIAL ACCOUNT
BANKS: PLEASE DO NOT CANCEL ON RIGHT HALF OF THIS ORDER IN SPACE RESERVED FOR ELECTRICAL ACCOUNTING MACHINES.
SECRETARY-TREASURER
LICENSED FOR USE UNDER PATENT 1,772,492 I.B.M. 127379

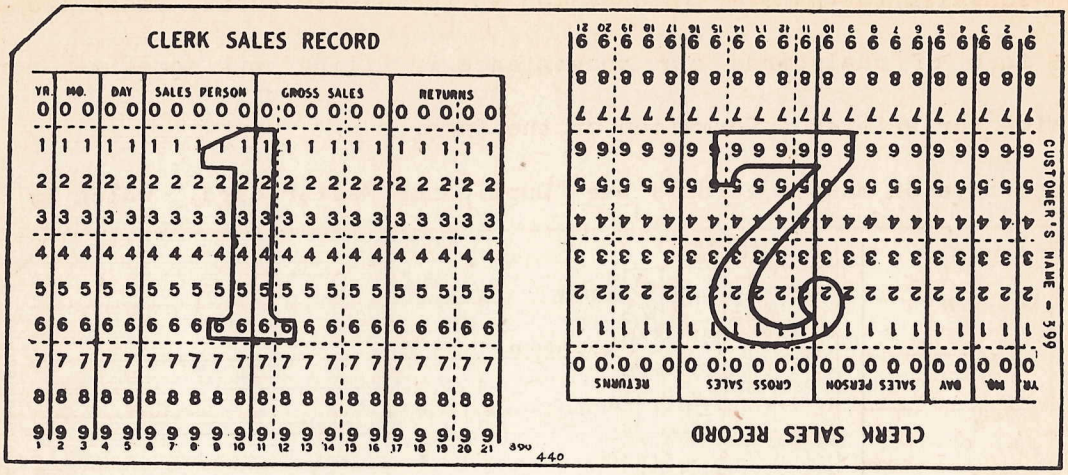
as they combine the functions of the written bank check and of the tabulating card in which some of the written information is recorded by means of punched holes.

In designing card checks the punched information should usually be at the extreme right and should interfere as little as possible with the check portion of the card. A note to the bank cautioning against cancelling in the space reserved for punching should always be included on the face of the card.

Multiple Use Cards

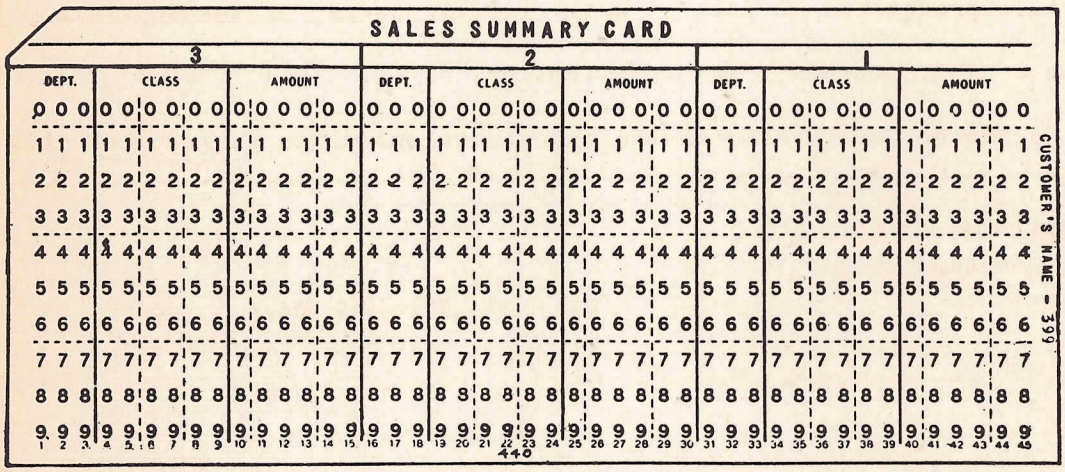
The multiple use card is a transcript card which can be used two or more times for the same work, or for two different types of work, at different periods. Dual cards may also be designed for multiple use, although it is generally true that in practice, dual cards, being original records, must be kept permanently and are, therefore, not available for re-use.

One form of multiple use card is the "Tumble Card". This card is so designed that the portion reserved for its second or subsequent use is inverted. The position of the corner cut then assures that all cards are correctly turned. A tumble card usually permits the use of a single skip bar in the punch and a



single plugboard set-up in the tabulator.

Another form of multiple use card is the "Sectional Card" which may be chosen where more than two uses are to be made of the same card, or where the



separate sections are used on entirely different applications.

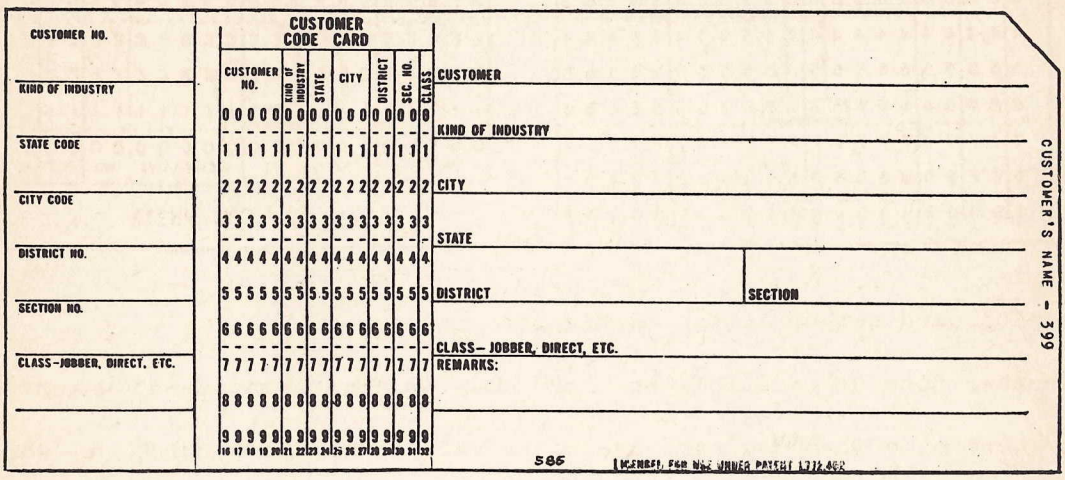
Multiple Use Cards are designed in the same manner as transcript cards, except that one or more sections may be inverted. Their only purpose is to reduce the cost of cards, when a small number of columns will suffice, and they can be employed only where no permanent card file must be maintained.

Master Cards

These cards take no part in the machine system other than to actuate a

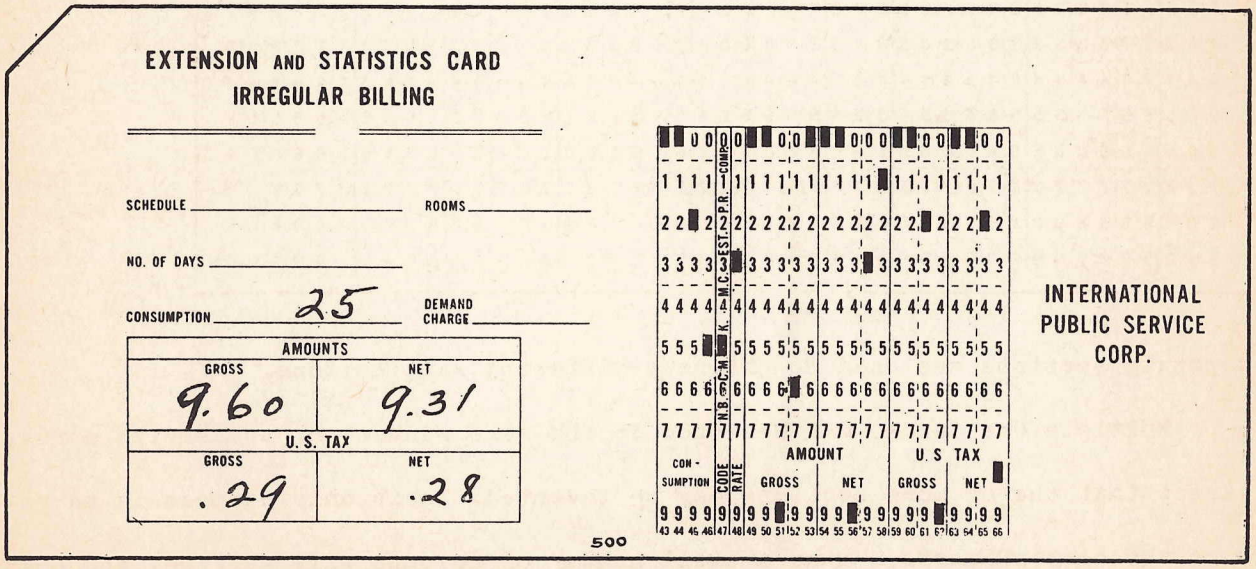
punch mechanism to transfer information to the active cards. They are usually in the form of dual cards for convenience in filing and sometimes contain a provision for written information on the face.

One type of master card is the "Duplicator Master Card," which is used to



transfer certain predetermined data to active detail cards in the duplicator, to facilitate coding, punching, and verification.

A "Set-Up Master Card" performs the same functions in the gang punch, dif-

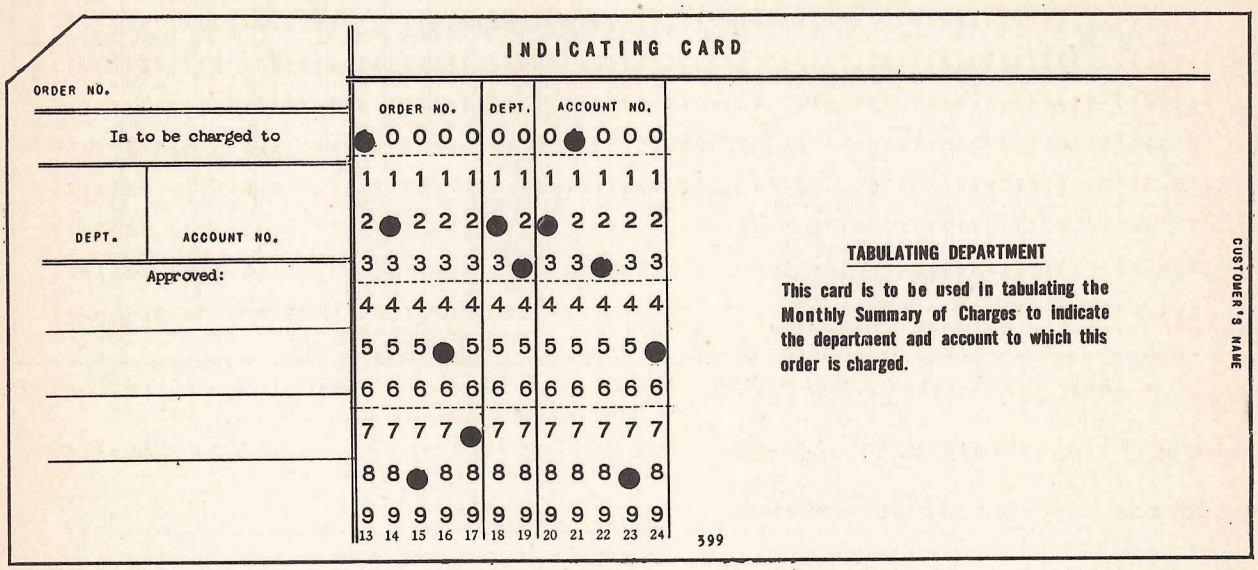


fering from the duplicator master card principally in its application.

Master Cards are usually designed with the punched information at, or near, the left end, although those columns must always be used which are necessary to produce agreement with the corresponding active card forms.

Indicating Cards

Any card designed to be inserted with active cards for the purpose of producing a special type of report is termed an "Indicating Card." When this card



is designed to provide special spacing, such as insuring proper alignment with preprinted forms, it is called a "Space Card."

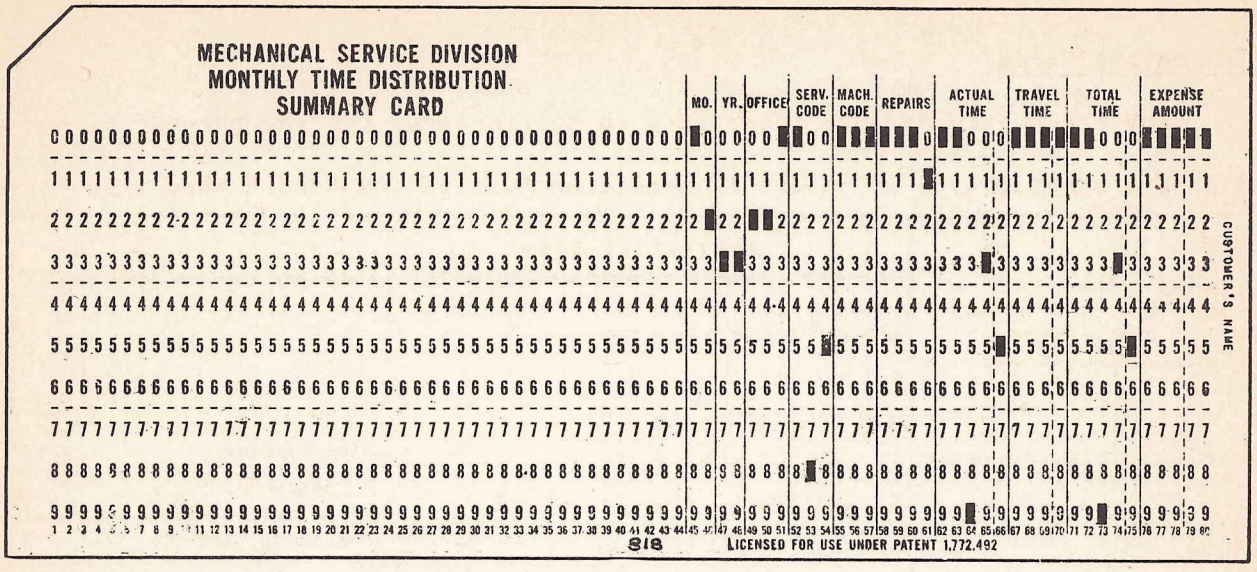
"Coding Cards" are indicating cards which are inserted to identify groups or to amplify the descriptive information beyond that normally supplied by the cards with which they are used.

Other forms of indicating cards may be employed to aid in special sorting operations, to influence automatic control, or to perform special functions in filing. These cards cannot be specifically defined or termed due to their miscellaneous nature.

The design of any Indicating Card is definitely determined by the design of the detail cards which they supplement.

Summary Cards

Any card designed for the purpose of recording totals secured from tabulations of other cards is termed a "Summary Card." When this type of card represents the result of a balancing operation it is also called a "Balance Card."

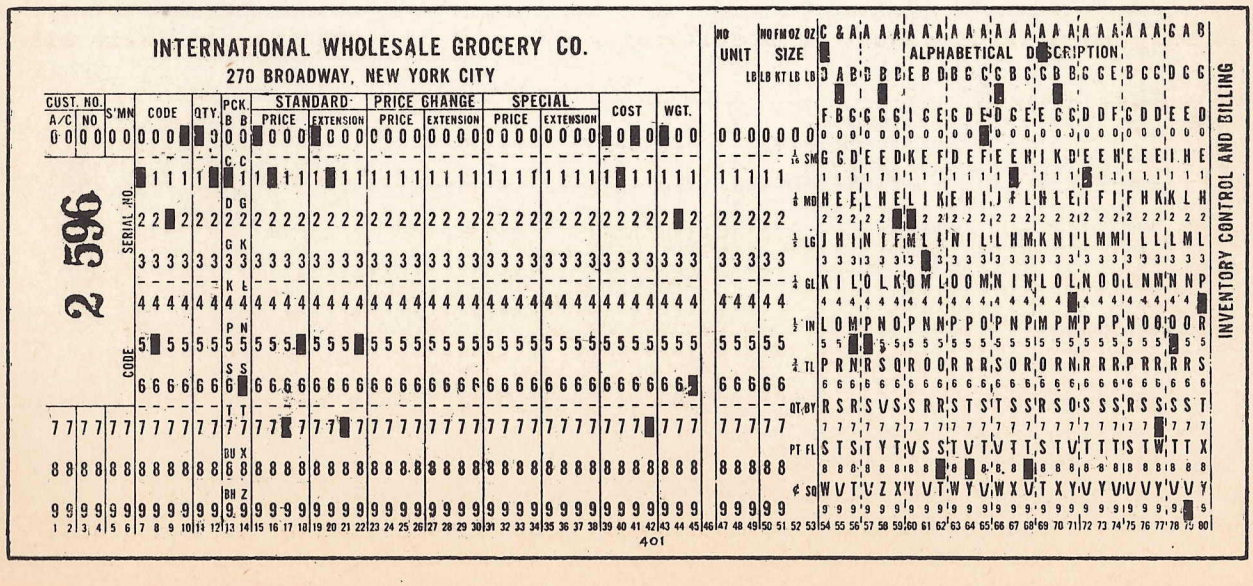


In many cases the same summary card form may be used for recording the totals of intermediate tabulations from different sources, so that final consolidated reports may be secured.

In designing summary cards care must be taken that they are properly aligned with any other cards with which they may be used and that they provide for proper identification of source.

Cards to be automatically punched in the summary punch must be carefully designed to conform with the specifications of this device. Any duplicated information should be to the left in order to obtain the highest speed.

Prepunched Cards



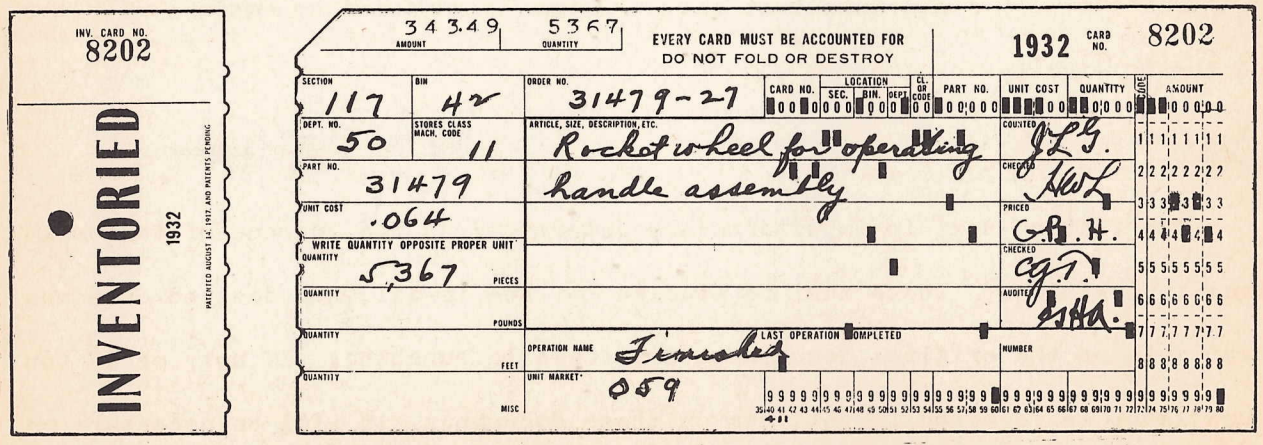
"Prepunched Cards" are cards which are wholly or partially punched with data in advance of their use as detail transaction cards.

They are usually gang punched and stored in files from which they are withdrawn as needed for current work. Where it is necessary for these cards to be identified in the files such identification becomes an important factor in card design.

Prepunched cards, in general, are used in one of three ways. In the first case they are the original and only cards in the routine and become active cards when pulled. In the second case they are again the only cards, but must be completed by subsequent punching. In the third case they become the first transaction cards and act as the master cards for the detail cards that follow.

Stub Cards

Any type of card which is used originally with a stub attached is termed a "Stub Card." Since the stubs are detached before the cards are put in any machines, the card proper may be designed according to the requirements of any card type, dual cards being most popular in practice.



Stub cards are used whenever it is desired to leave some identification of work, material or transaction at an originating point from which the cards

have been removed. They are also used extensively to provide a binding margin when it is desired to assemble card forms in pads, interleaved with paper forms or carbons.

DETERMINATION OF CARD DATA

The first step in card design is to determine the data which will be needed from the card in order to meet the requirements of the contemplated record routine. In order to accomplish this all of the following factors must be considered in the order presented.

Report Requirements

Of all the factors affecting card design the most important are the requirements of the finished reports to be prepared by the Electric Tabulating and Accounting Machines. These reports should be kept in mind constantly so that all necessary information may be included in the card and arranged to facilitate their final preparation.

The factors so determined may be considered as the desired or ideal card requirements. Certain modifications may then be required to conform with any of the following limiting conditions.

Availability of Data

The factors next in importance are determined by the sources of the original information. These must be studied to see if all the desired data are available on the original documents to be used in punching. If not, or if too much labor is required to get them on these documents, it will be necessary to revise the list of card data, or substitute other data which will accomplish a similar purpose. A study of the source records will also determine whether a dual card can be used advantageously to replace these records. It will further

show whether certain data which is available can be conveniently included in the card and a new use devised which was not originally planned, or which may be needed in the future. At this point also, a study of reference punching should be made so that the card may be identified with the original record from which it is punched, if this is necessary. Dual cards will need no reference punching since they are also the original records.

Summarizing Card Data

After the above studies have been completed the final results should be prepared in list form. This list will serve in assigning the proper number of columns to each field and may be conveniently divided into the following three groups for the purposes of discussion:

Reference Data--Date, Invoice No., etc.
Controlling Data--Branch, Salesmen, Product, etc.
Adding Data--Quantity, Amount, etc.

PUNCHES

PART 1 5

MANUAL OF INSTRUCTION
LESSON NO.

INTERNATIONAL BUSINESS MACHINES CORPORATION
EDUCATIONAL DEPARTMENT
ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 2—18

PUNCHES

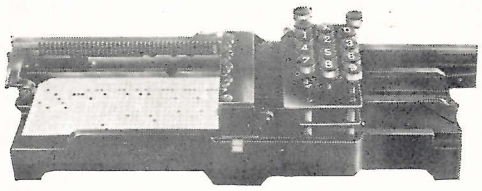
The basic materials with which the tabulating department has to deal are the original record of a business transaction and the tabulating card to which the data are to be transcribed by means of punched holes.

We have considered the design of the card and the care which must be taken in the design to simplify the operation of punching. Similarly, care must be exercised in the preparation of the original record to provide the data in such form that they may be readily transcribed.

In those instances where some of the data must have numerical designations or codes applied, this operation is usually performed before key punching is started.

The punching operation is the most important step in tabulating procedure, for upon the speed and accuracy of the punch operator depends much of the success of a tabulating installation.

Due to the complex structure of modern business, there exist many types of original records. To facilitate the transcription of these records to cards most efficiently and economically, it was only logical that specialized machines should be developed. International has met this need with a wide line of punches. Different models are available; one which is operated entirely by hand; another whose cutting dies are electrically actuated; one which is further equipped with duplicating features; a fourth which has automatic card feeding and ejecting devices; another which is designed to punch many cards from a master set-up. In addition, there are several highly specialized machines for specific purposes. All of these are briefly described in the following data sheets.



Mechanical Key Punch

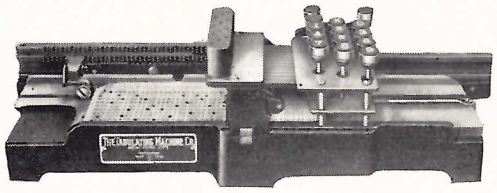
THE Mechanical Key Punch is used to record data on tabulating cards by means of punched holes, thereby preparing accurate, permanent and unalterable records.

No electrical energy is required to operate this machine. Simplicity of design and ruggedness of construction have made it an efficient and economical factor in many installations of the Electric Accounting Method. Two other advantages are its portability and the small amount of space it occupies.

The mechanical key punch has fourteen punching keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card. The other two are a space key and a release key.

Each individual card is placed by the operator in the carriage of the machine prior to punching. As the punching operation proceeds the machine automatically spaces to the left, thus bringing each column of numerals on the card into the punching position. When the proper information has been recorded in this manner, the operator removes the card, inserts another, and repeats the process.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what she has punched.



Mechanical Verifier

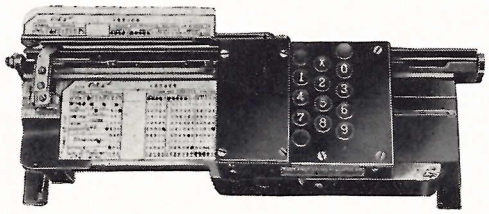
THE Mechanical Verifier is used as a mechanical means of proving the accuracy with which the punching operation was performed.

The theory of mechanical verification is identical with that of any checking procedure, viz., that repetition of the work by a different person reveals the errors made by the one who originally performed the task.

The manual operation of the verifier is identical with that of the key punch. The punched card is placed in the verifier and the operator, reading data from the punching source, proceeds as though actually punching. If a key is struck which does not correspond to the hole punched in the card, the carriage of the verifier does not advance, thus calling attention to an error. Comparison of the original data and the punched card is then made to determine whether the error was made in punching or verifying. The verifier is so constructed that the operator cannot see the punched holes to be verified. This, of course, eliminates sight suggestion of correctness.

Mechanical verification greatly reduces the human element hazard in the checking procedure and gives definite assurance that the punched hole records are dependably correct.

Pro. No. 15



Electric Key Punch

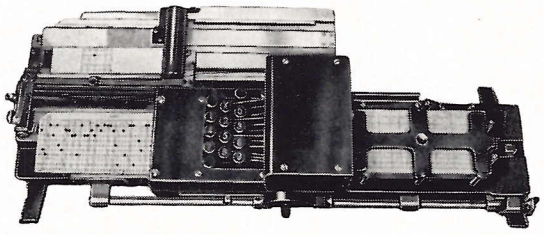
THE Electric Key Punch is used to record data on tabulating cards by means of perforations, thereby preparing accurate, permanent and unalterable records for the electric accounting method.

Simplicity of design and ruggedness of construction make this machine a highly efficient device. Its small size enables it to be carried easily from place to place.

The key board has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key.

Each individual card is placed by the operator in the carriage of the machine prior to punching. As the punching operation proceeds, the machine automatically spaces to the left, thus bringing each column of numerals on the card in the punching position. When the proper information has been recorded in this manner, the operator removes the card and, after inserting another, repeats the process.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what she has punched. The limited number of keys and their extremely light touch assure the rapid acquirement of operating skill.



Duplicating Key Punch

THE Duplicating Key Punch is used to record data on tabulating cards by means of punched holes. Information common to more than one card can be recorded automatically; information pertaining to an individual card is recorded by the operator. All the information contained on a tabulating card or any portion of it can be automatically reproduced on other tabulating cards by this device.

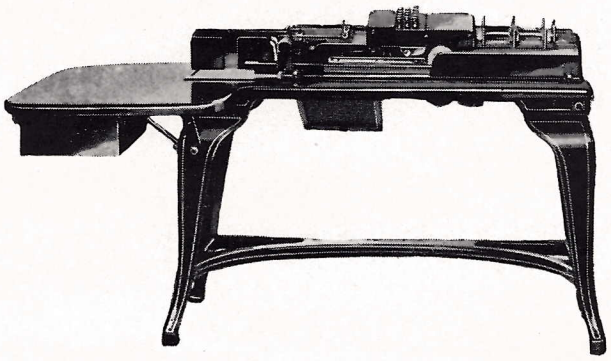
The key board has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key. The duplicating device, which permits the recording of predetermined data, is actuated by a punched card placed in the duplicating card rack. The speed of the duplicating operation is approximately ten columns per second.

This duplicating feature is extremely useful as an automatic coding device. Master cards are pre-punched with all of the codes which pertain to any given set of transactions. Placing the proper master card in the duplicating rack then results in the automatic transfer of these codes in punched form to the detail cards. This not only eliminates individual coding but expedites punching and makes verification of these codes unnecessary.

A stack of unpunched cards is placed in the magazine from which the cards are fed one at a time into the punching mechanism by a hand operated slide. The operation of this slide adjusts the machine for punching. Cards also may be fed into the punch by hand from the left without removing or in any way disturbing those in the magazine.

As each perforation is made, the carriage automatically moves one space to the left until all desired columns on the card have been punched. When the last column has been perforated, the operator removes the card and automatically sets the punching mechanism to repeat the process.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what she has punched. The small number of keys and their extremely light touch assure the rapid acquirement of skilled operation.



Motor Drive Key Punch

THE Motor Drive Key Punch is used to record data on tabulating cards by means of punched holes, thus preparing permanent and unalterable records for the Electric Accounting method.

The key board has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key. The sloping keyboard is placed at the proper height for convenient operation.

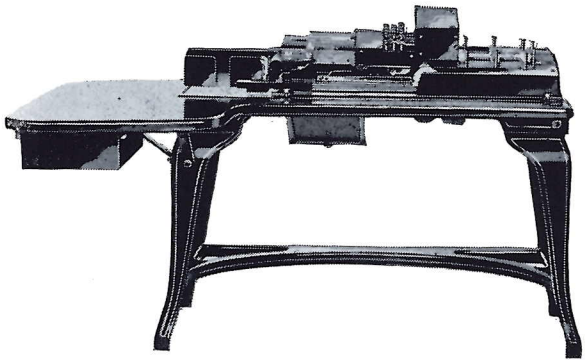
This punch is equipped with automatic card-feeding and card-ejecting devices which are so arranged that after a punched card has been ejected, a card from the magazine is automatically fed into the punching position. Cards may be fed into the punch by hand from the left without removing or in any way disturbing those in the magazine rack.

The operation of this machine is very simple. The only requirement on the operator's part is to press the proper keys; all other movements are automatically performed.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what she has punched.

The machine is mounted on an attractive, sturdy, steel table. A reading board at the left of the punch provides a convenient place for holding the original written records from which the data are transferred.

Pro. No. 7—2M—10-10-34—M&E



Motor Drive Duplicating Key Punch

THE Motor Drive Duplicating Key Punch is used to record data on tabulating cards, by means of perforations, for electric accounting purposes. Information common to more than one card can be recorded automatically; information pertaining to an individual card or any portion of it can be automatically reproduced on other tabulating cards by this device.

The key board has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key. The duplicating device, which permits the recording of pre-determined data, is actuated by a punched card placed in the duplicating card rack. The speed of the duplicating operation is approximately ten columns per second.

This duplicating feature is extremely useful as an automatic coding device. Master cards are pre-punched with all of the codes which pertain to any given set of transactions. Placing the proper master card in the duplicating rack then results in the automatic transfer of these codes in punched form to the detail cards. This not only eliminates individual coding but expedites punching and makes verification of these codes unnecessary.

The punch is equipped with automatic card feeding and automatic card ejecting devices which are so arranged that after a punched card has been ejected a blank card is automatically fed into the punching position. Cards also may be fed into the punch by hand from the left without removing or in any way disturbing those in the magazine.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what she has punched.

The operation of this device is very simple inasmuch as all the operator need do is press the keys to make the desired perforations. All other operations are automatically performed. The automatic features and the limited number of keys assure a rapid acquirement of skilled operation.

The machine is mounted on an attractive, sturdy steel table. A reading board at the left of the punch provides a convenient place for the original records from which the information is being transcribed.

Motor Drive Verifier

THE Motor Drive Verifier is used to prove mechanically the accuracy of data punched in tabulating cards.

The theory of mechanical verification is identical with that of any checking procedure, viz., that repetition of the work by a different person reveals errors made by the person who originally performed the task.

The manual operation of the verifier is the same as that of the key punch. The punched card is automatically fed into the machine and the operator, reading data from the punching source, proceeds as though actually punching. If a key is struck which does not correspond to the hole punched in the card, the carriage of the verifier does not advance, thus calling attention to an error. Comparison of the original data and the punched card is then made to determine whether the error was made in punching or in verifying.

If there are no errors in the punched card it is automatically ejected and the next card is automatically fed into the machine. This automatic feed and eject feature is a great aid in making mechanical verification a highly efficient procedure.

The verifier is so constructed that the operator cannot see the punched holes to be verified. This, of course, eliminates sight suggestion of correctness.

Mechanical verification reduces the human element hazard in the checking procedure and gives definite assurance that the punched hole records are dependably correct.

The Alphabetic Duplicating Punch

THE Alphabetic Duplicating Punch is used to record alphabetic and numerical information in tabulating cards in such a manner that complete words and names, together with numerical data can subsequently be printed by the Alphabetic Accounting Machine.

Information common to more than one card can be recorded automatically; information pertaining to an individual card or any portion of it can be automatically duplicated to other tabulating cards. This duplicating feature is extremely useful as an automatic coding device. Master cards are pre-punched with all of the codes which pertain to any given set of transactions. Placing the proper master card in the duplicating rack then results in the automatic transfer of these codes in punched form to the detail cards. This not only eliminates individual coding but expedites punching and makes verification of these codes unnecessary.

The Punching mechanism is controlled by two keyboards, one of which has both alphabetic and numerical keys, arranged to correspond with those of a typewriter. The other is the same as the keyboard of a numerical key punch and is provided for convenience of operation and to attain maximum production, the operator using whichever keyboard is more familiar in punching numerical data.

The Alphabetic Duplicating Punch is equipped with automatic feed and eject, and is mounted on an attractive steel table. A reading board at the left provides a convenient place for holding the original records from which the information is being transferred.

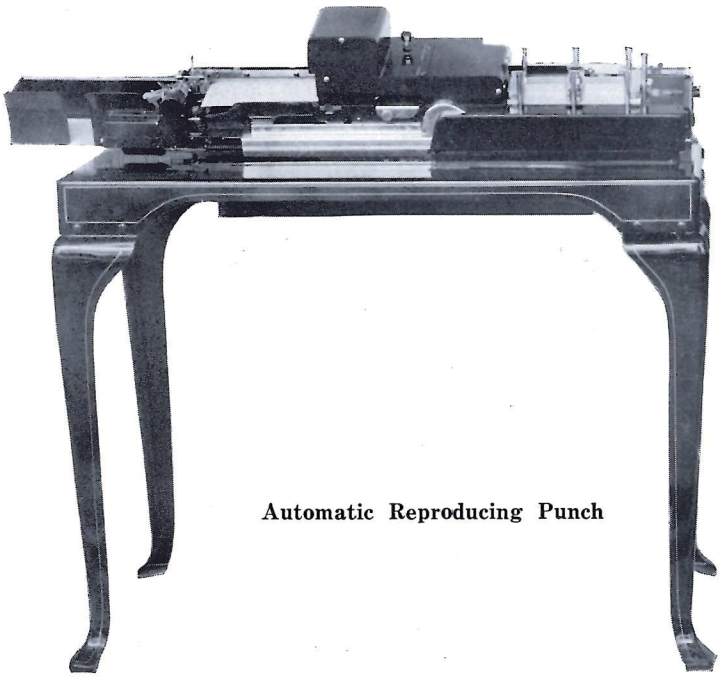
Alphabetic Printing Punch

THE International Printing Punch is used to record both alphabetic and numerical data on tabulating cards by means of punched holes, at the same time printing this information on the top of the card. Thus the machine provides a means of interpreting the holes punched for tabulating purposes into legible characters, aiding greatly the checking, filing, or reference operations.

The operation of the International Printing Punch is controlled by a standard typewriter keyboard, the feeding and ejecting of the cards being entirely automatic. The familiar typewriter tabular inserts control the skipping of the card to the proper card columns and when inserted in the inverted position operate a signal bell when the predetermined column is reached.

The machine is mounted on an attractive steel base of a convenient height for operation from a seated position. The large waste receptacle mounted beneath the machine does not limit the ample leg room provided, and the reading board at the left provides a convenient place for the original records from which the information is transcribed.

The International Printing Punch is noted for its extremely light action, every movement being power driven; the keys merely engaging the operating mechanism.



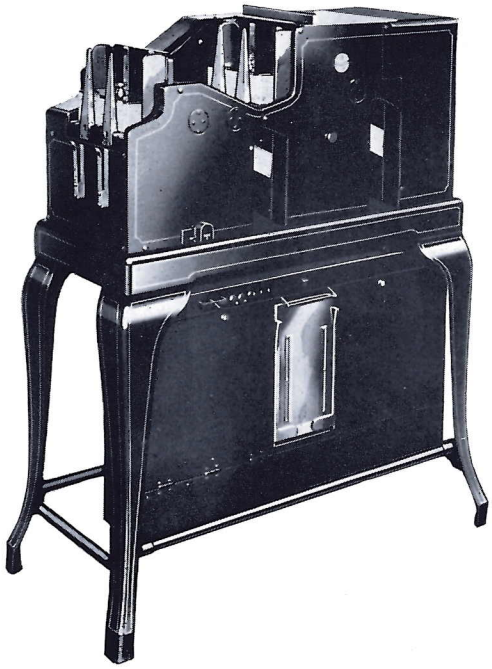
Automatic Reproducing Punch

THE Automatic Reproducing Punch is used to reproduce automatically one set of punched cards from another set.

This machine consists of two separate and complete units mounted on the same base. One of these units is termed the "Reading Unit" and the other the "Punching Unit." Punched cards are automatically fed into the former at the same time that the unpunched cards are automatically fed into the latter. The reading unit then transmits the impulses to the punching unit which punches the second card.

All or any part of the data on the original card may be reproduced on any part of the second card providing the sequence of fields, or information groups, remains the same. The machine can be arranged to stop so that key punched data can be manually introduced on the new card in any predetermined columns. When this feature is not in use the machine is entirely automatic in its performance. An automatic stopping device signals the exhaustion of cards in either unit. The reproducing speed of this machine when operating automatically ranges from 1,600 cards per hour for reproducing ten columns to 440 cards per hour for full 80-column cards.

The reproducing feature of the punch can be made inoperative by throwing a switch. The "Punching Unit" then functions as a regular Motor Drive Duplicating Key Punch for manual punching, master card punching, etc., being equipped with all the features of the regular motor drive punches.

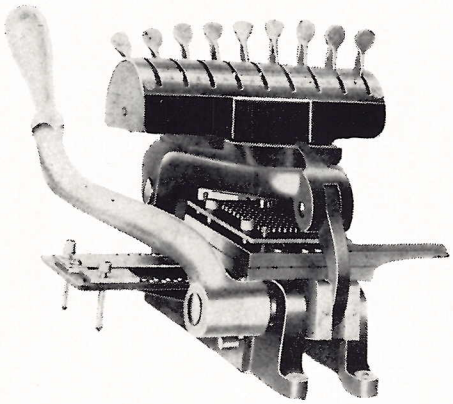


International Reproducing Punch

THE International Reproducing Punch provides a means for reproducing all or any portion of the information, either numerical or alphabetic, which has been punched in one group of cards into another group of cards. It is also possible to gang punch information from one master card into a desired number of detail cards. All operations are effected automatically, as the master cards pass through the machine.

Both reproducing and gang punching may be accomplished simultaneously; that is, while information is being reproduced into a group of cards, additional data may be gang punched into the same cards from a prepunched master set-up card.

The International Reproducing Punch operates at a constant speed of 100 c. p. m. for all types of work, regardless of the number of holes which are punched.



Lever Set Gang Punch

THE Lever Set Gang Punch is used to punch in a single operation, data common to a number of cards.

This punch is simple in design, is ruggedly constructed, and weighs only 25 pounds. Its light weight gives it the advantage of portability. No electric power is required for its operation.

The machine is prepared for punching by setting the levers which control those punching dies which will make the desired perforations. This is done by means of a clearly marked lever guide chart.

The capacity of this machine is 10 consecutive columns simultaneously punched in a group ranging from 8 to 10 cards. These ten columns, or any columns less than ten, may be punched in any portion of the card by properly positioning the cards under the dies.

The operation of this machine is very simple. The operator sets the levers at their proper positions, places the group of cards in the bed of the machine, and pulls the hand lever which causes the cards to be punched.

Motor Drive Gang Punch

THE Motor Drive Gang Punch provides an automatic means of recording on tabulating cards all data which is common to a number of cards.

The columns to be punched may be set up in the machine in two ways, by using a prepunched master card, which performs the set-up automatically—or by hand setting each column individually. A combination of both methods may also be used when required.

The operation of this machine is very simple. The operator is required only to place the group of cards in the feed box, set up the punching bars on the columns to be punched by one of the methods described above, and to press the starting button. The machine then punches automatically at the rate of 125 cards per minute.

One important feature of this machine is the card counting device. A dial is set to register the number of cards to be punched; when that quantity has been punched the machine automatically stops. Another feature is the card numbering attachment which is available at a slight additional cost for automatically printing serial numbers or identification numbers on the cards as they are gang punched.

Throughout the entire design of this machine careful consideration has been given to speed, automatic features, and simplicity of operation.

PUNCHES

PART 2

MANUAL OF INSTRUCTION
LESSON NO. 6

INTERNATIONAL BUSINESS MACHINES CORPORATION
EDUCATIONAL DEPARTMENT
ENDICOTT, N. Y.

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FORM 2—18—4

PUNCHES

This booklet is not intended to explain all of the operating principles of punches. Only a few of the important facts with regard to their mechanics will be discussed.

The chart which appears below (Figure 1) shows the method of operation which the key punch operator follows in order to reach the maximum production with the least amount of effort and fatigue. This diagram also gives a good idea of the appearance of the Standard Electric Key Punch.

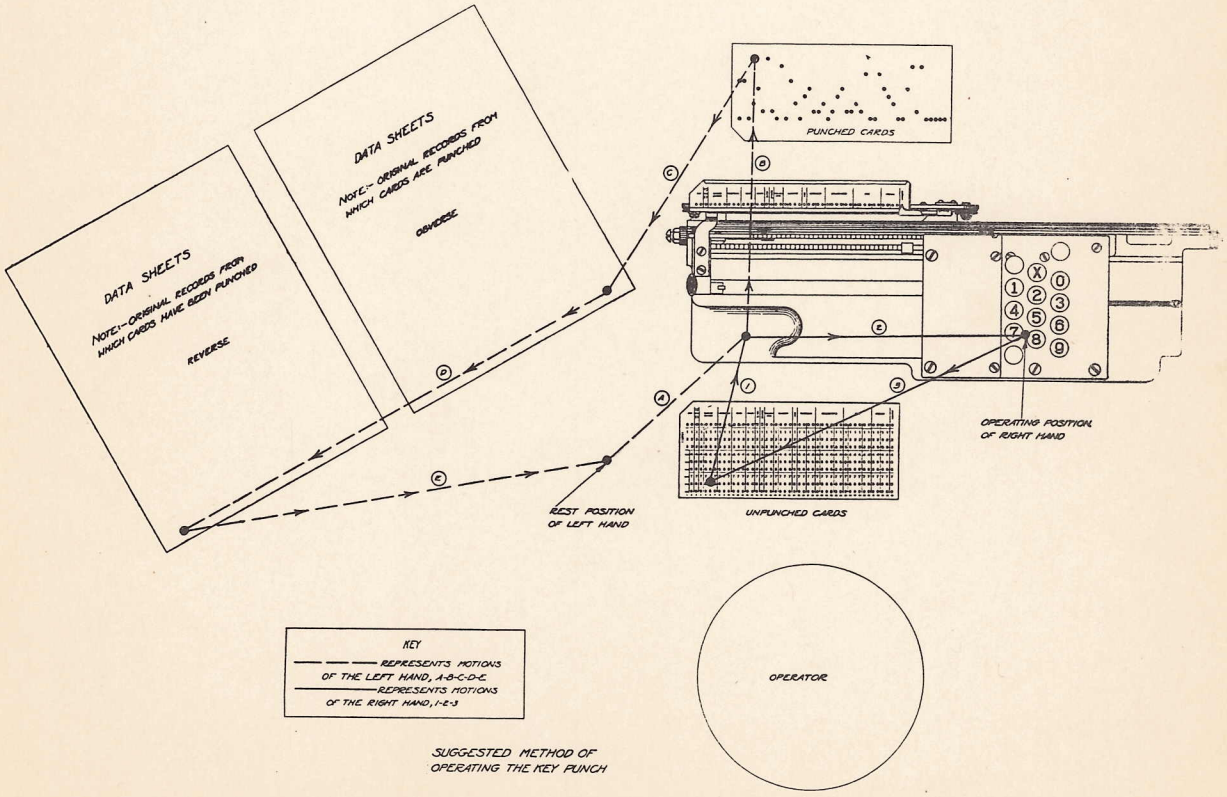
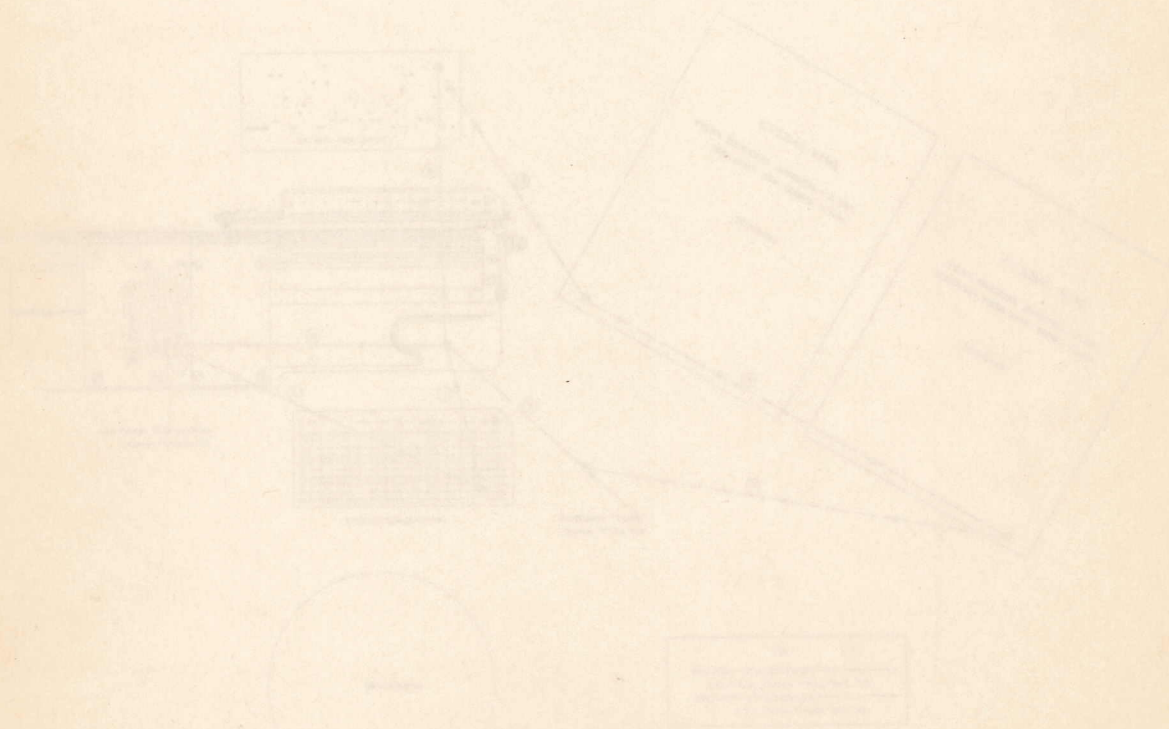

DATA SHEETS
NOTE:- ORIGINAL RECORDS FROM WHICH CARDS HAVE BEEN PUNCHED
REVERSE
DATA SHEETS
NOTE:- ORIGINAL RECORDS FROM WHICH CARDS ARE PUNCHED
OBVERSE
PUNCHED CARDS
UNPUNCHED CARDS
REST POSITION OF LEFT HAND
OPERATING POSITION OF RIGHT HAND
KEY
REPRESENTS MOTIONS OF THE LEFT HAND, A-B-C-D-E.
REPRESENTS MOTIONS OF THE RIGHT HAND, 1-2-3
OPERATOR
SUGGESTED METHOD OF OPERATING THE KEY PUNCH

FIGURE 1.
Suggested Method of Operating the Key Punch



THE MECHANICAL OPERATION OF THE STANDARD ELECTRIC KEY PUNCH.

Upon pressing any key the corresponding interposer (which is connected to the key by means of a bell crank) is moved forward under the motor plate bar and over the corresponding punch. As the interposer moves forward, it carries with it a contact door. When the contact door moves forward, a contact hook is moved up, closing the punch magnet contact, thus completing the punch magnet circuit.

When this circuit is completed the magnet becomes energized and attracts its armature. The armature when drawn to the cores, transmits motion through another link to the motor plate. The interposer is by this time under the motor plate bar and fully over its corresponding punch. The punch is driven through the card by the motor plate.

As the interposer and punch are pushed down, the rock shaft is moved, causing the escapement pawl to engage in the rack tooth and the dog to disengage and move over ready to engage the next tooth.

When the armature returns to its normal position, the motor plate is lifted; therefore the rock shaft is moved, causing the escapement pawl to lift and the dog to engage the tooth.

This operation is repeated each time the motor plate is moved by the armature, thus spacing the card rack forward one space.

Upon depressing the "X" key, the corresponding interposer is moved forward as described above, but when the motor plate is pulled down, the "X" pallet on the rock shaft is moved, causing the "T" lever to move which in turn projects a small bar called the skip lifter. This skip lifter when thus projected, rides on the "X" bar, and causes the carriage or rack to skip certain predetermined columns.

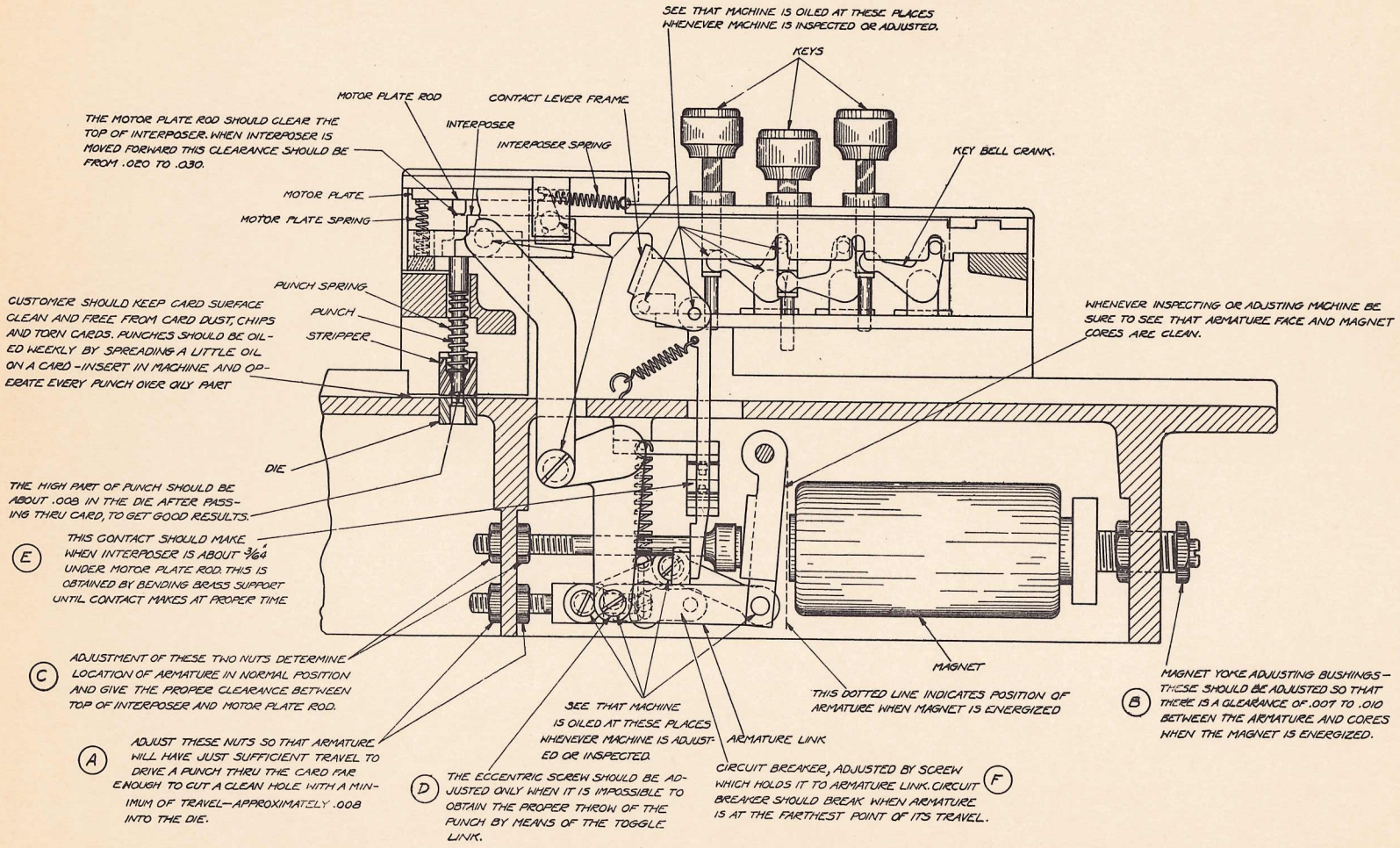
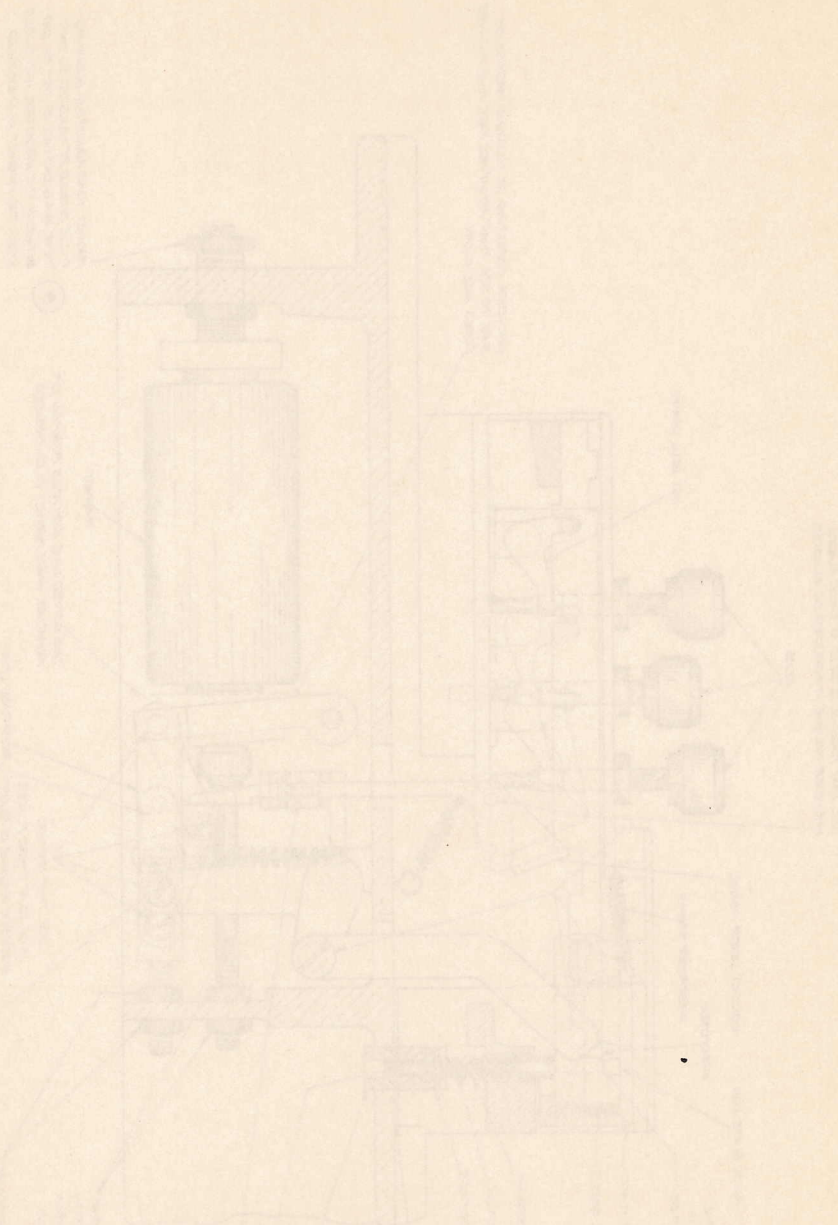

SEE THAT MACHINE IS OILED AT THESE PLACES WHENEVER MACHINE IS INSPECTED OR ADJUSTED.
KEYS
MOTOR PLATE ROD
CONTACT LEVER FRAME
INTERPOSER
INTERPOSER SPRING
THE MOTOR PLATE ROD SHOULD CLEAR THE TOP OF INTERPOSER. WHEN INTERPOSER IS MOVED FORWARD THIS CLEARANCE SHOULD BE FROM .020 TO .030.
KEY BELL CRANK.
MOTOR PLATE
MOTOR PLATE SPRING
PUNCH SPRING
PUNCH
STRIPPER
CUSTOMER SHOULD KEEP CARD SURFACE CLEAN AND FREE FROM CARD DUST, CHIPS AND TORN CARDS. PUNCHES SHOULD BE OILED WEEKLY BY SPREADING A LITTLE OIL ON A CARD - INSERT IN MACHINE AND OPERATE EVERY PUNCH OVER ONLY PART
WHENEVER INSPECTING OR ADJUSTING MACHINE BE SURE TO SEE THAT ARMATURE FACE AND MAGNET CORES ARE CLEAN.
DIE
THE HIGH PART OF PUNCH SHOULD BE ABOUT .008 IN THE DIE AFTER PASSING THRU CARD, TO GET GOOD RESULTS.
E
THIS CONTACT SHOULD MAKE WHEN INTERPOSER IS ABOUT 3/64 UNDER MOTOR PLATE ROD. THIS IS OBTAINED BY BENDING BRASS SUPPORT UNTIL CONTACT MAKES AT PROPER TIME
C
ADJUSTMENT OF THESE TWO NUTS DETERMINE LOCATION OF ARMATURE IN NORMAL POSITION AND GIVE THE PROPER CLEARANCE BETWEEN TOP OF INTERPOSER AND MOTOR PLATE ROD.
A
ADJUST THESE NUTS SO THAT ARMATURE WILL HAVE JUST SUFFICIENT TRAVEL TO DRIVE A PUNCH THRU THE CARD FAR ENOUGH TO CUT A CLEAN HOLE WITH A MINIMUM OF TRAVEL—APPROXIMATELY .008 INTO THE DIE.
SEE THAT MACHINE IS OILED AT THESE PLACES WHENEVER MACHINE IS ADJUSTED OR INSPECTED.
D
THE ECCENTRIC SCREW SHOULD BE ADJUSTED ONLY WHEN IT IS IMPOSSIBLE TO OBTAIN THE PROPER THROW OF THE PUNCH BY MEANS OF THE TOGGLE LINK.
ARMATURE LINK
CIRCUIT BREAKER, ADJUSTED BY SCREW WHICH HOLDS IT TO ARMATURE LINK. CIRCUIT BREAKER SHOULD BREAK WHEN ARMATURE IS AT THE FARTHEST POINT OF ITS TRAVEL.
F
THIS DOTTED LINE INDICATES POSITION OF ARMATURE WHEN MAGNET IS ENERGIZED
MAGNET
B
MAGNET YOKE ADJUSTING BUSHINGS — THESE SHOULD BE ADJUSTED SO THAT THERE IS A CLEARANCE OF .007 TO .010 BETWEEN THE ARMATURE AND CORES WHEN THE MAGNET IS ENERGIZED.

FIGURE 2.



THE ELECTRIC DUPLICATING KEY PUNCH.

In a previous lesson we described the importance of the duplicating key punch. This device is valuable because it eliminates manual coding and punching; and also furnishes a simple, rapid method of replacing damaged cards.

A general diagram of the over-all view of this machine is printed below (Figure 3) to make you familiar with some of the general terms which will be discussed in more detail.

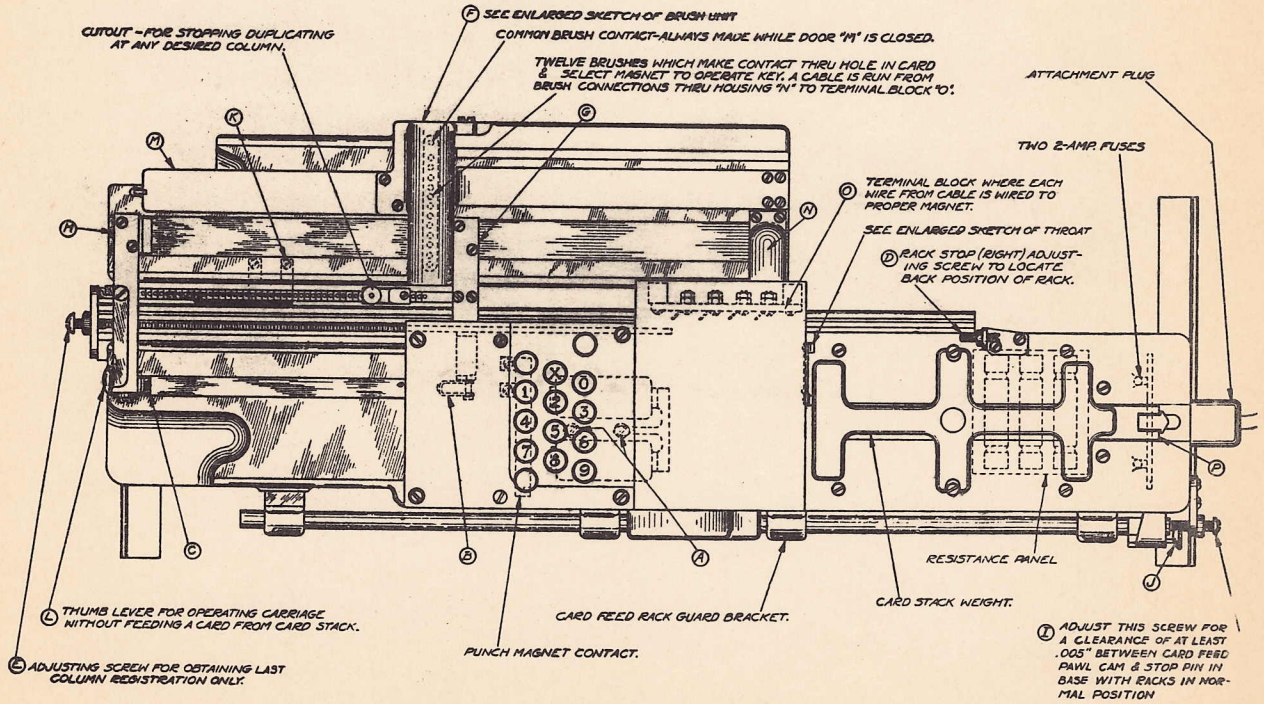
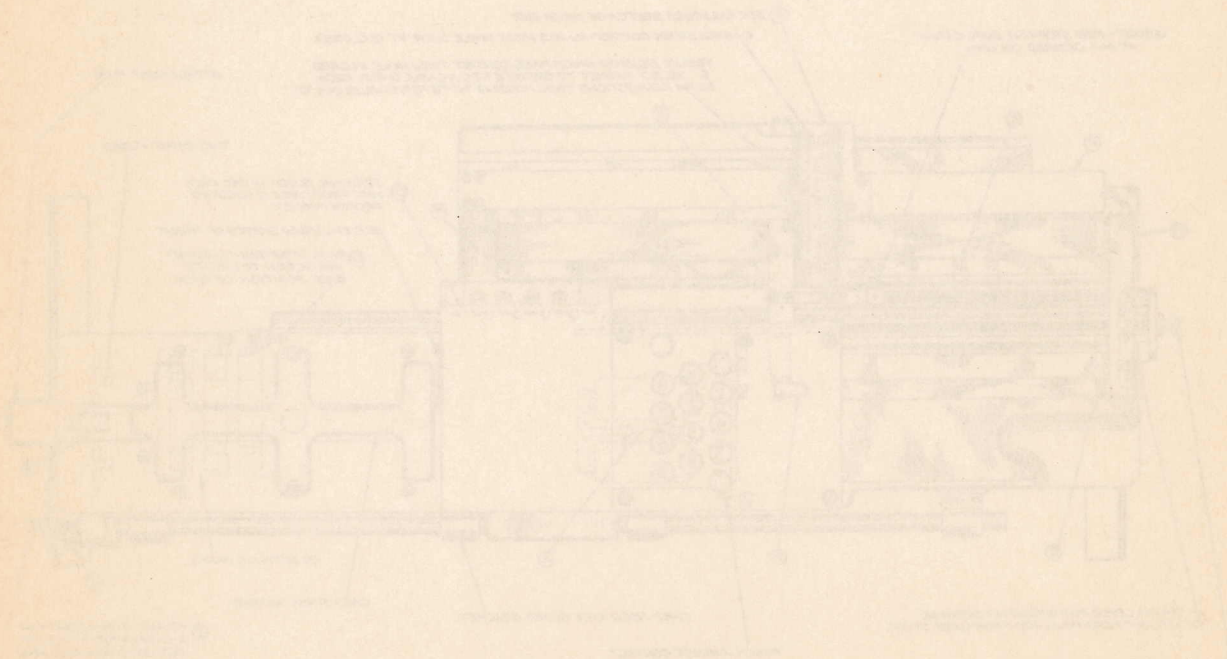

(F) SEE ENLARGED SKETCH OF BRUSH UNIT
CUTOUT - FOR STOPPING DUPLICATING AT ANY DESIRED COLUMN.
COMMON BRUSH CONTACT - ALWAYS MADE WHILE DOOR "M" IS CLOSED.
TWELVE BRUSHES WHICH MAKE CONTACT THRU HOLE IN CARD & SELECT MAGNET TO OPERATE KEY. A CABLE IS RUN FROM BRUSH CONNECTIONS THRU HOUSING "N" TO TERMINAL BLOCK "O".
ATTACHMENT PLUG
TWO 2-AMP. FUSES
TERMINAL BLOCK WHERE EACH WIRE FROM CABLE IS WIRED TO PROPER MAGNET.
SEE ENLARGED SKETCH OF THROAT
(D) RACK STOP (RIGHT) ADJUSTING SCREW TO LOCATE BACK POSITION OF RACK.
RESISTANCE PANEL
CARD STACK WEIGHT.
(L) THUMB LEVER FOR OPERATING CARRIAGE WITHOUT FEEDING A CARD FROM CARD STACK.
CARD FEED RACK GUARD BRACKET.
(I) ADJUST THIS SCREW FOR A CLEARANCE OF AT LEAST .005" BETWEEN CARD FEED PAWL CAM & STOP PIN IN BASE WITH RACKS IN NORMAL POSITION
PUNCH MAGNET CONTACT.
(E) ADJUSTING SCREW FOR OBTAINING LAST COLUMN REGISTRATION ONLY.

FIGURE 3.



When the electric duplicating key punch is used for manual key punching, its operation is similar to that of the electric key punch.

When the machine is used for automatic duplication, however, its operation is considerably different.

A punched tabulating card is placed in the "upper" or "master card" rack, and a duplicating door is closed. This raises a set of brushes that sense the holes in the master card and permits the transmission of an electrical impulse to actuate an electromagnet. When the magnet is energized it attracts an armature which in turn actuates the duplicating punching armature lever, and causes the corresponding key to be depressed.

The means by which this is accomplished is best illustrated by the following diagram (Figure 4).

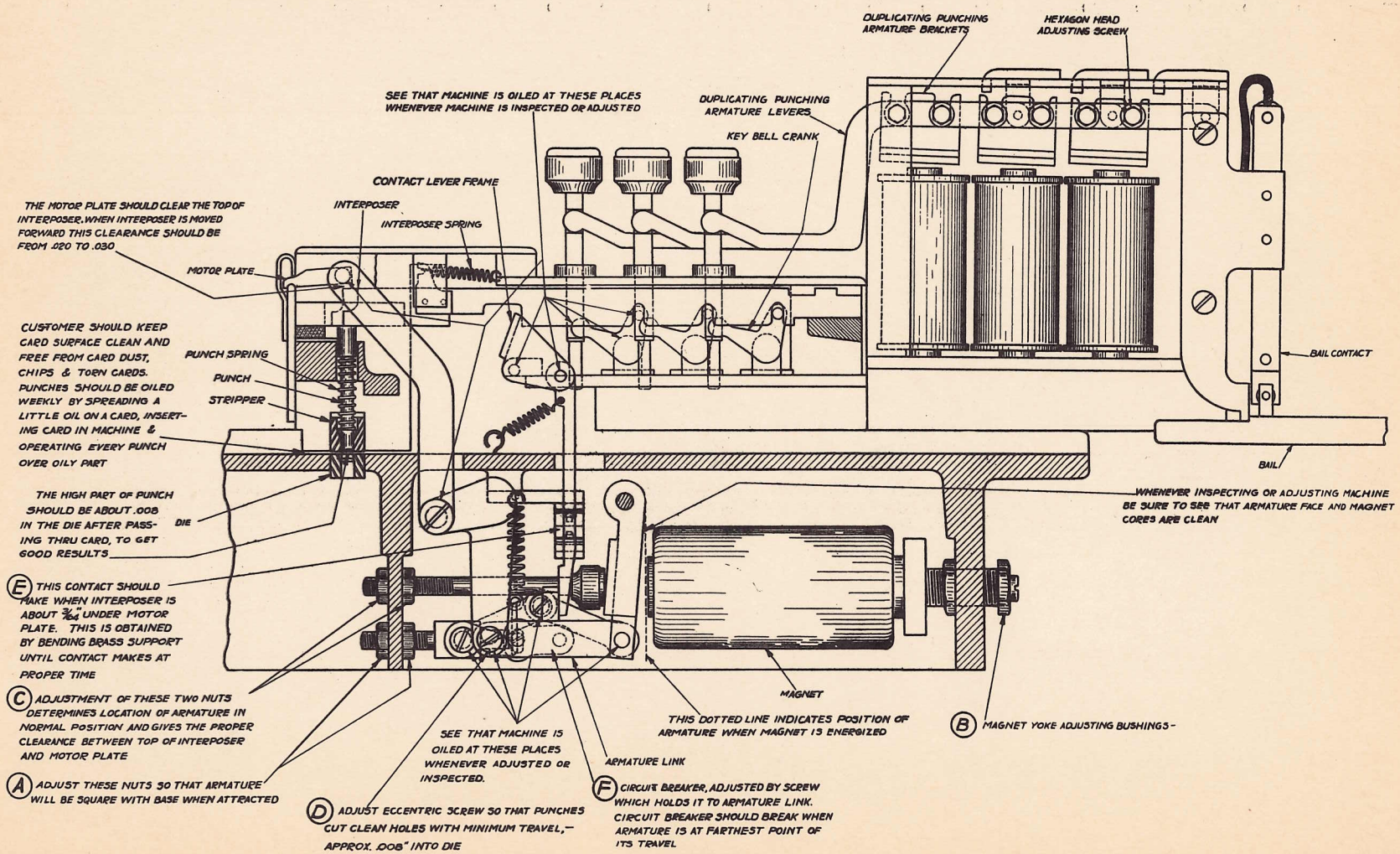
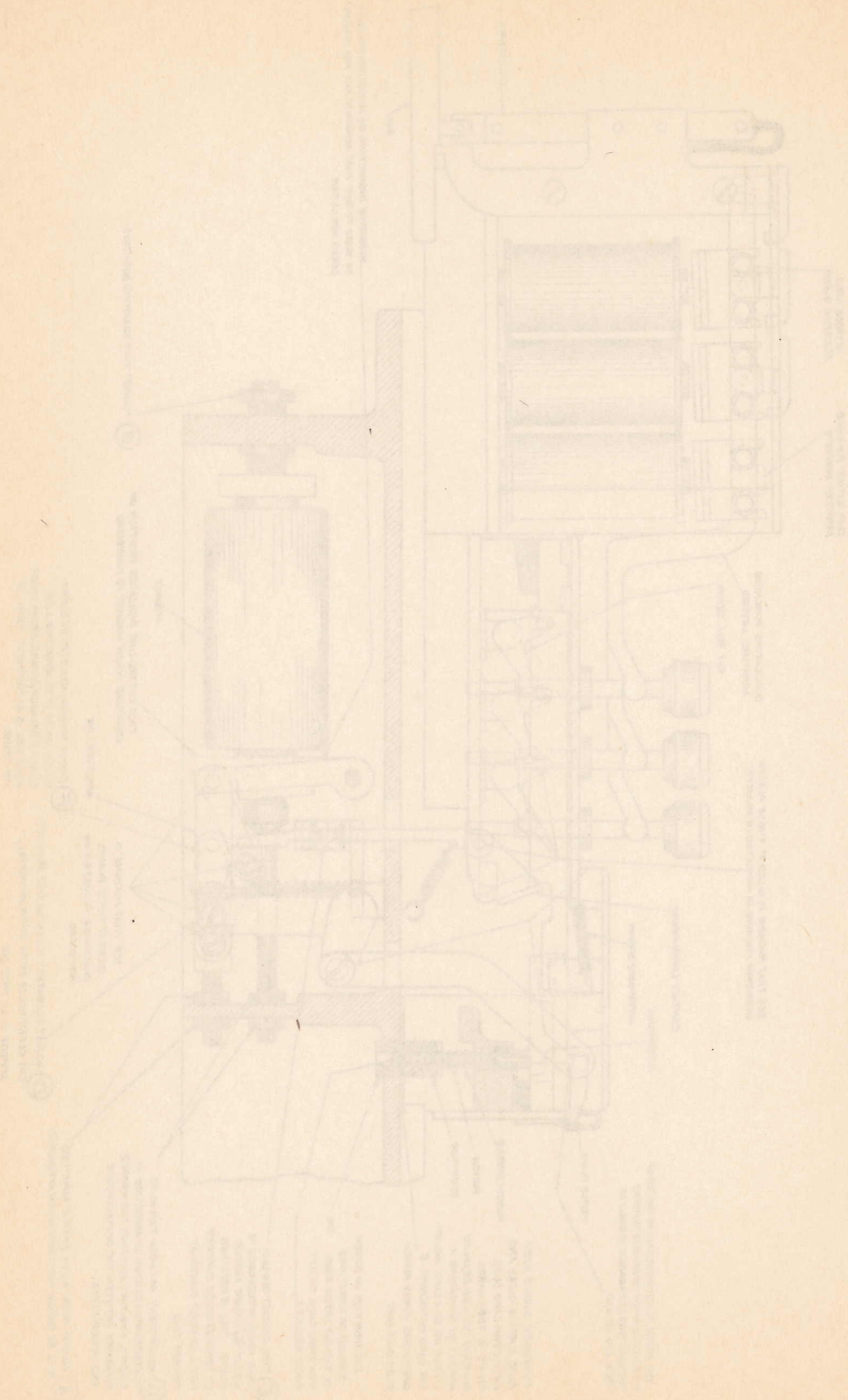

DUPLICATING PUNCHING ARMATURE BRACKETS
HEXAGON HEAD ADJUSTING SCREW
SEE THAT MACHINE IS OILED AT THESE PLACES WHENEVER MACHINE IS INSPECTED OR ADJUSTED
DUPLICATING PUNCHING ARMATURE LEVERS
KEY BELL CRANK
CONTACT LEVER FRAME
INTERPOSER
INTERPOSER SPRING
THE MOTOR PLATE SHOULD CLEAR THE TOP OF INTERPOSER. WHEN INTERPOSER IS MOVED FORWARD THIS CLEARANCE SHOULD BE FROM .020 TO .030
MOTOR PLATE
BAIL CONTACT
CUSTOMER SHOULD KEEP CARD SURFACE CLEAN AND FREE FROM CARD DUST, CHIPS & TORN CARDS. PUNCHES SHOULD BE OILED WEEKLY BY SPREADING A LITTLE OIL ON A CARD, INSERTING CARD IN MACHINE & OPERATING EVERY PUNCH OVER OILY PART
PUNCH SPRING
PUNCH
STRIPPER
BAIL
WHENEVER INSPECTING OR ADJUSTING MACHINE BE SURE TO SEE THAT ARMATURE FACE AND MAGNET CORES ARE CLEAN
THE HIGH PART OF PUNCH SHOULD BE ABOUT .008 IN THE DIE AFTER PASSING THRU CARD, TO GET GOOD RESULTS
DIE
(E) THIS CONTACT SHOULD MAKE WHEN INTERPOSER IS ABOUT 3/64" UNDER MOTOR PLATE. THIS IS OBTAINED BY BENDING BRASS SUPPORT UNTIL CONTACT MAKES AT PROPER TIME
(C) ADJUSTMENT OF THESE TWO NUTS DETERMINES LOCATION OF ARMATURE IN NORMAL POSITION AND GIVES THE PROPER CLEARANCE BETWEEN TOP OF INTERPOSER AND MOTOR PLATE
MAGNET
THIS DOTTED LINE INDICATES POSITION OF ARMATURE WHEN MAGNET IS ENERGIZED
(B) MAGNET YOKE ADJUSTING BUSHINGS
SEE THAT MACHINE IS OILED AT THESE PLACES WHENEVER ADJUSTED OR INSPECTED.
ARMATURE LINK
(A) ADJUST THESE NUTS SO THAT ARMATURE WILL BE SQUARE WITH BASE WHEN ATTRACTED
(D) ADJUST ECCENTRIC SCREW SO THAT PUNCHES CUT CLEAN HOLES WITH MINIMUM TRAVEL,— APPROX. .008" INTO DIE
(F) CIRCUIT BREAKER, ADJUSTED BY SCREW WHICH HOLDS IT TO ARMATURE LINK. CIRCUIT BREAKER SHOULD BREAK WHEN ARMATURE IS AT FARTHEST POINT OF ITS TRAVEL

FIGURE 4.



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PUNCHES

PART 3 7

MANUAL OF INSTRUCTION
LESSON NO. 7

INTERNATIONAL BUSINESS MACHINES CORPORATION
EDUCATIONAL DEPARTMENT
ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 2—18—5

FACTS TO KNOW ABOUT KEY PUNCHES AND GANG PUNCHES

The following questions are answered for each type of key punch described in the data sheets included in PUNCHES-PART 1.

1. UPON WHAT FACTORS DOES THE SPEED OF CARD PUNCHING DEPEND?

The speed of punching depends upon

(a) The kind of machine used
(b) The physical condition of the operator
(c) The arrangement of the machines to provide the operators with proper light and working room.
(d) The design of cards according to the sequence of the data to be punched
(e) The clearness of the original writing on the documents
(f) The amount of punching to be done by hand
(g) The similarity of the work
(h) The kind of supervision
(i) The amount of experience of the punch operator
(j) The use of the touch system in operating the machine.

2. ON WHAT CURRENT DOES THE PUNCH OPERATE?

All electric punches except the Alphabetic Printing Punch operate on 110 or 220 volts -- direct current. The Alphabetic Printing Punch operates on either direct or alternating current -- 110 or 220 volts.

3. WHAT COLUMNS MAY BE SEEN AT THE RIGHT WHEN THE CARD IS FULLY INSERTED?

On the mechanical key punch, it is possible to see 19 columns of a 45 column card. On the electric key punch, it is possible to see 8 columns of the 45. It is possible to see two-thirds more columns of an 80 column card than of a 45 column card. No columns are visible on those machines which have a magazine feed.

4. HOW MAY CARDS BE FED INTO THE DUPLICATING AND MOTOR DRIVE PUNCHES?

Cards may be fed automatically from the right, or from the left, by hand.

5. HOW MANY CARDS CAN BE AUTOMATICALLY FED AT ONE TIME?

Only one.

6. HOW MANY CARDS CAN BE FED BY HAND AT ONE TIME?

One or two cards, depending upon the construction of the machine.

7. WHAT ARE THE PURPOSES OF THE SPACE KEY?

To advance the card one column position to the right without punching a hole; and also to permit double punching on the electrically operated punches.

8. WHAT ARE THE PURPOSES OF THE RELEASE KEY?

To release the card carriage so that the card may be removed.

9. WHAT ARE THE PURPOSES OF THE "X" KEY?

The "X" key on the several types of punches (both mechanical, electrical and motor drive type) is used: --

(a) To punch the 11th position on a card
(b) When so arranged, to skip a field in which no information is to be punched.

10. HOW MUCH PRESSURE IS NECESSARY TO ACTUATE A KEY?

To actuate the mechanical key punch requires a force of approximately 1½ lbs. to 1-3/4 lbs. However, to actuate an electrical key punch requires only 4 ounces of force. The punches equipped with alphabetical keyboard require only 2 ounces to depress a key.

11. WHY DOES IT REQUIRE LESS EFFORT TO OPERATE AN ELECTRIC KEY PUNCH THAN A MECHANICAL?

In the case of the mechanical punch, the operator must do all the work; i. e., supply the necessary force to actually punch the hole in the card. In the electrical punches, all the operator does is close a contact which causes the machine to punch the hole.

12. WHAT KINDS OF SKIP BARS MAY BE USED?

X skip bars and automatic skip bars.

13. HOW MANY COLUMNS CAN BE SKIPPED AT ONE DEPRESSION OF THE "X" KEY?

Without a governor, six or eight; with a governor, as many as desired.

14. WILL THE DUPLICATOR FUNCTION IN SKIPPED FIELDS ALSO?

The standard duplicator will not function unless a skip bar is used. The alphabetic duplicator will function in skipped fields.

15. WHERE IS THE PREDETERMINED CUT-OUT BAR ATTACHED?

On the lower edge of the duplicator rack (Or master card bed.)

16. WHAT IS THE FUNCTION OF THE PREDETERMINED CUT-OUT BAR?

To prevent punching from certain punched fields of the master card and to resume duplicating at a predetermined point.

17. WHERE IS THE CARD CARRIAGE STOP LOCATED AND WHAT IS ITS PURPOSE?

It is located directly behind and below the upper edge of the card bed on all electric key punches. On the mechanical, it is on the upper edge of the card base. On all automatic feed and eject machines, it is directly behind the feed magazine. It is used to stop the carriage at a predetermined point when inserting cards from the left.

18. IS THERE A CUT-OUT STOP ON THE PUNCH AND WHAT IS ITS PURPOSE?

There is a cut-out stop on all duplicating punches. Its purpose is to stop duplication from a fully punched master card at a predetermined point

19. IS THERE A GOVERNOR ON THE PUNCH AND WHAT IS ITS PURPOSE?

There is a governor on all electrically operated punches and it is used to control the speed of the carriage release.

20. AT HOW MANY ANGLES MAY THE MACHINE BE ADJUSTED BY USE OF THE FEET?

Only standard electric and duplicating key punches are equipped with feet which may be used to adjust the punch to convenient angles.

21. HOW MAY MORE THAN ONE HOLE BE PUNCHED IN A SINGLE COLUMN, IF DESIRED?

More than one hole may be punched in a single column on electrically operated punches by depressing the space key until the additional holes have been punched. On mechanical punches, two keys may be depressed simultaneously.

22. APPROXIMATELY HOW MANY COLUMNS CAN BE DUPLICATED PER SECOND?

Approximately ten to twelve columns may be duplicated per second.

23. WILL THE MACHINE DUPLICATE -- (a) A DOUBLE-PUNCHED COLUMN?
(b) AN UNPUNCHED COLUMN?

The alphabetic duplicator is the only machine which will duplicate a double punched column or an unpunched column.

24. WHAT IS THE MASTER CARD RACK?

The master card rack is the rack or bed located at the top of the machine on which the cards to be duplicated are placed.

25. WHAT SHOULD ALWAYS BE THE POSITION OF THE DOOR OF THE MASTER CARD RACK WHEN THE MASTER CARD OR CODE CARD IS NOT BEING USED? WHY?

The door of the master card rack should be up when not in use in order that the circuit through the duplicating brushes be broken.

26. WHAT MEANS ARE THERE OF STOPPING THE DUPLICATING MECHANISM AT A GIVEN COLUMN, OTHER THAN THE CUT-OUT STOP?

The duplicating mechanism may be stopped at a given point by using a high skip bar: predetermined cut-out bar; opening the door of the master card rack; grasping the left finger lever of the carriage; use of mask cards; etc.

27. HOW SHOULD CARDS BE CHECKED AFTER DUPLICATION?

It is not necessary to check after duplication, but you can use a sight check, if desired.

28. HOW IS BACK SPACING EFFECTED?

Back spacing is effected on all punches except the alphabetic printing punch by manually pushing the carriage back one space. The latter punch, however, has a back space key.

29. WHAT IS THE PURPOSE OF THE CARD GAUGE AND HOW OFTEN SHOULD IT BE USED?

The card gauge is used to see if the punching mechanism is properly aligned. It should be used every morning before punching is begun.

30. HOW ARE JAMMED CARDS REMOVED?

First remove the guide plate and move the carriage in half way. Then it is possible to reach in and pull the card out.

-o-

The following questions are answered for each type of gang punch described in PUNCHES-PART 1.

31. IN WHAT CARD COLUMN CAPACITY ARE LEVER SET GANG PUNCHES FURNISHED?

The lever set gang punch is furnished to punch 34 or 45 column cards.

32. WHAT IS THE MAXIMUM NUMBER OF CARDS INTO WHICH IT IS ADVISABLE TO PUNCH COMMON INFORMATION AT ONE OPERATION?

The maximum number of cards that it is advisable to punch in one operation is ten.

33. WHAT IS THE EXTENSION STOP AND WHAT IS ITS PURPOSE?

The extension stop is a device that adjusts the position of the card under the punches. This device allows the gang punching of any ten consecutive columns up to, and including number 31.

34. WHAT KIND OF CURRENT IS USED TO OPERATE THE MOTOR DRIVE GANG PUNCH? WHAT VOLTAGE?

The motor drive gang punch operates on 110 or 220 volt direct current.

35. HOW MANY COLUMNS MAY BE GANG PUNCHED?

It is possible to punch any, or all columns of the card in the motor drive gang punch.

36. AT WHAT NORMAL SPEED DOES THE PUNCH OPERATE?

The motor drive gang punch operates at a speed of 125 cards per minute.

37. HOW SHOULD THE CARDS BE PLACED IN THE FEEDING MAGAZINE?

(a) OF THE STANDARD MACHINE?

Cards are fed face down with the lower edge in.

(b) OF THE CHAIN STORE MACHINE?

Cards are fed with face up and top edge in.

38. HOW OFTEN SHOULD THE CARDS BE REMOVED FROM THE STACKER?

Cards should be removed from the stacker in quantities which may be conveniently removed with one hand.

39. STATE THE METHOD OF SETTING UP THE MACHINE --

(a) BY MEANS OF A MASTER CARD.

The prepunched card is placed under the pin box and the head lowered.

(b) WITHOUT A MASTER CARD.

A blank card is set in the pin box, rack set-up bars set at desired location and then locked in.

40. IF IT IS DESIRED TO RETAIN A SET-UP IN CERTAIN COLUMNS, HOW CAN THE REMAINING COLUMNS BE CLEARED WITHOUT AFFECTING THE PERMANENT SET-UP?

This may be accomplished by depressing the rack locks at the front of the machine. These locks make it possible to clear all of the machine except the locked positions.

41. HOW CAN THE PERMANENT SET-UP BE CLEARED?

By depressing rack lock release key. This then makes the permanent set-up positions operative and they may be cleared by turning the crank at the left side of the machine.

42. WHEN USING A MASTER CARD SET-UP, IF THE CARD CONTAINS INFORMATION IN CERTAIN COLUMNS WHICH ARE NOT TO BE GANG PUNCHED, WHAT STEPS ARE NECESSARY?

Lock out the columns which are not to be gang punched before making the set-up.

43. IF THE MASTER CARD HAS A DOUBLE-PUNCHED COLUMN, WHICH HOLE WILL BE GANG PUNCHED?

The punched hole nearest the throat of the machine; that is, the first one fed into the machine.

44. IF IT IS DESIRED TO PUNCH EXACTLY 350 CARDS FROM ONE MASTER CARD, WHAT STEPS MUST BE TAKEN?

The indicating pointer must be set at "3" and the larger dial must be set at "50."

45. HOW MAY THE CARDS BE NUMBERED AT THE SAME TIME THAT THEY ARE GANG PUNCHED?

By inserting a numbering head and setting it to stamp each card coming through in the desired sequence and turning a PRINT switch ON.

46. WHERE IS THE NUMBERING HEAD LOCATED --

(a) ON THE STANDARD MACHINE?

Inside, underneath.

(b) ON THE CHAIN STORE MACHINE?

Outside, above.

47. IS IT POSSIBLE TO ELIMINATE ZEROS TO THE LEFT OF THE NUMERAL? IF SO, HOW?

Yes. Move the zero of the stamp just beyond the printing position. Then press zero toward the center of the printing wheel and move it back to its normal printing position. It will sink into the wheel and will not print.

48. HOW IS THE NUMBERING HEAD SET UP FOR THE STARTING NUMBER?

The wheels are set to read one less than the desired number and the head inserted in its holder.

49. WHAT ADJUSTMENT IS NECESSARY TO HAVE THE NUMBERING HEAD RECORD CONSECUTIVE, DUPLICATE, or REPEAT NUMBERS?

A lever on the wheel of the numbering head is set at one of three index letters: "C" for "Consecutive;" "D" for "Duplicate;" and "R" for "Repeat."

50. WHAT ARE THE NECESSARY STEPS TO TAKE IN REMOVING A DAMAGED CARD?

If the damaged card has not reached the punching die, a plate on which the numbering head is attached may be raised. If the damaged card is under the die, it is necessary to turn the wheel directly under the machine which raises the head of the machine. The card may then be taken out by hand.

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INTERNATIONAL BUSINESS MACHINES CORPORATION

TABULATING MACHINE DIVISION

EDUCATIONAL DEPARTMENT

EXAMINATION ON IBM PRODUCTS

NOVEMBER 18 1935

DIRECTIONS

If you think a statement is true, place a plus ( ) sign on the line to the left of the statement. If any part of it is false, place a zero (0) on the line to the left. DO NOT GUESS.

MISTAKES ARE TWICE AS COSTLY AS OMISSIONS.

Frank J. Lucas
(NAME)

91
(GRADE)

FORM 2-18-8

6 1/2

INTERNATIONAL BUSINESS MACHINES CORPORATION

TABULATING MACHINE DIVISION

EDUCATIONAL DEPARTMENT

EXAMINATION ON IBM PRODUCTS

NOVEMBER 15, 1932

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(NAME) (GRADE)

FORM E-18-8

1. 0 Dr. Hollerith's method of tabulation was selected for compiling the returns for the 1820 census.

2. 0 The pantograph type of punch had twelve punching keys.

3. 0 The first sorting device used by Dr. Hollerith deposited cards into the proper pockets automatically.

4. 0 The modern punching machine has a set of 13 key-actuated punches.

5. X 0 In the modern tabulator, brushes make electrical contact through the perforations in the cards, thereby actuating magnets to trip the counters.

6. 0 + In the first Hollerith tabulating machines, brushes made electrical contact through the perforations in the cards, thereby actuating magnets to trip the counters.

7. 0 The fields in the cards used by Dr. Hollerith in his early work were arranged in vertical columns extending from the top to the bottom of the card.

8. + Our tabulating cards are furnished in 34, 45, or 80 column capacity.

9. + The development of business machines was the logical outcome of the speeding up and growth of modern business methods.

10. + By means of electric tabulating and accounting machines it is often possible to discover wrong tendencies which may be rectified before they have an opportunity to progress to the point of a great loss to the business.

11. 0 Wood from selected northern oak trees is used exclusively in the manufacture of our card stock.

12. + The brushes in the speck detector touch every point on the paper surface, and although their electric potential or pressure is not as high as that of the brushes of the tabulator or sorter, imperfections cannot pass these brushes without forming a contact and closing a circuit.

13. 0 Tabulating cards must have one of the four corners cut as they will not go through the tabulating machines otherwise.

14. 0 It is immaterial where the tabulating cards are stored in a customer's office as the paper stock from which they are made is thoroughly seasoned before the cards are printed.

15. 0 Cards which are punched from information previously recorded on some other record are called dual cards.

16. + Generally dual cards should be designed with the space for writing to the left so that when a card is positioned in the punch, the written information is visible to the operator.

17. 0 Multiple use cards are especially useful where permanent card files must be maintained.

18. + Master cards are usually designed with the punched information at, or near, the left end.

19. + Stub cards are used to great advantage in inventory work or whenever it is desired to leave some identification at the points from which the cards are removed.

20. 0 The punched information on a tabulating card check should be at the extreme left so that it will not interfere with the endorsement on the back.

21. + Any card designed for the purpose of recording totals secured from tabulations of other cards is properly called a summary card.

22. 0 Tumble cards must have two corners cut.

23. + The relative location of the punching keys on the keyboard of the electric key punch is the same as on that of the mechanical key punch.

24. + If a 5-column field is to be skipped by means of the X-key and a skip bar, 1000 space key depressions will be saved in 250 cards.

25. 0 Approximately the same pressure is required to punch two cards at one time in the electric key punch as is required to punch a single card in the mechanical key punch.

26. 0 + The Mechanical Key Punch is so designed that the card column being punched is visible while the key is being depressed.

27. 0 If a skip bar is used, the skip lifter will be actuated only if the 12 key is depressed.

28. 0 Unintentional double punching in a single column is prevented by a special device which is part of all key punches.

29. + It is possible to double punch any column on a Mechanical Key Punch.

30. + The verifier operator always verifies the punched holes in the card against the original accounting record, such as the invoice.

31. 0 If a key of the verifier other than the one corresponding to the hole to be verified is depressed, the carriage automatically moves forward, thus permitting the operator to make a visual check of the punching with the original record.

32. + The cards are placed in the rack and removed from the Electric Key Punch manually.

33. + The duplicating device on the Duplicating Key Punch permits the automatic transfer of predetermined information from the master to the detail card.

34. 0 Cards may be fed into punching position only by the hand operated slide on the Duplicating Key Punch.

35. + The Motor Drive Key Punch provides for automatic card-feeding and card-ejecting.

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36. + If the operator makes a mistake in punching a card on the Motor Drive Duplicating Punch, depressing the release key will cause the rack to be released, the punched card ejected, and another card will be automatically fed in from the magazine.

37. 0 The duplicating speed of the Motor Drive Duplicating Key Punch is faster than that of the Standard Duplicating Key Punch.

38. 0 There are three types of Verifiers - Mechanical, Electric, and Motor Drive.

39. 0 It requires less pressure to operate the keys on Motor Drive Verifier than on the Mechanical Verifier.

40. 0 If there are two holes in the same column of a master card, the Motor Drive Duplicator will skip the double-punched column.

41. 0 Two cards can be automatically fed at one time.

42. + One or two cards, depending upon the construction of the machine, may be fed by hand at one time.

43. + The purpose of the space key is to advance the card one column position to the left without punching a hole; and also to permit double punching on the electrically operated punches.

44. + The purpose of the release key is to release the card carriage so that the card may be removed.

45. 0 A force of approximately 4 ounces is required to actuate the mechanical key punch. However, to actuate an electric key punch requires $1\frac{1}{2}$ lbs. to 1-3/4 lbs.

46. + The function of the predetermined cut-out bar is to prevent punching from certain punched fields of the master card and to resume duplicating at a predetermined point.

47. 0 A part is located directly behind and below the upper edge of the card bed on all Electric Key Punches. On the mechanical, it is on the upper edge of the card base. On all automatic feed and eject machines, it is directly behind the feed magazine. It is used to stop the carriage at a predetermined point when inserting cards from the left. Is it the governor?

48. X A fully punched 80-column card can be duplicated by means of the Motor Drive Duplicating Key Punch in approximately 8 seconds and a 45 column card in approximately 5 seconds.

49. + All electric punches except the Alphabetic Printing Punch operate on 110 or 220 volts D.C. The Alphabetic Printing Punch operates on either Direct or Alternating Current - 110 or 220 volts.

50. + The Alphabetic Duplicator will duplicate a double-punched column or an unpunched column.

51. + The door of the master card rack should be up when not in use in order that the circuit through the duplicating brushes be broken.

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52. + It is not necessary to verify the duplicated portion of the detail card.

53. + Back spacing is effected on all punches except the Alphabetic Printing Punch by manually pushing the carriage back one space. The latter punch, however, has a back space key.

54. + To set up the machine by means of a master card, the prepunched card is placed under the pin box and the head lowered.

55. + Numerical information may be punched on either of the two keyboards of the Alphabetic Duplicating Punch.

56. + Alphabetic information may be duplicated from the master card with the Alphabetic Duplicating Punch.

57. 0 If the master card has a double-punched column, both holes will be reproduced in the detail cards.

58. 0 The Alphabetic Duplicating Punch may be made to operate on either 110 or 220 alternating or direct current.

59. 0 The standard skip bar may be used to skip a field on the Alphabetic Printing Punch.

60. + The set-up of the Lever-set Gang Punch can be quickly changed by moving the ten levers in the semi-circular head.

61. 0 The Lever-set Gang Punch will punch 20 cards simultaneously.

62. 0 The Lever-set Gang Punch operates only on 110 or 220 volts Direct Current.

63. + Ten consecutive columns may be punched simultaneously on the Lever-set Gang Punch.

64. + The Motor Drive Gang Punch operates on 110 or 220 volt Direct Current.

65. 0 The Motor Drive Gang Punch operates at a speed of 150 cards per minute.

66. 0 The Motor Drive Gang Punch can be set up only by a master card.

67. + It is possible to punch any or all columns simultaneously on the Motor Drive Gang Punch.

MECHANICS OF THE PUNCH

68. 0 Every punch consists of three essential parts, the punch, the die, and the key.

69. 0 The contact door or contact lever frame is operated by the motor plate.

70. + Every punching key has an interposer.

71. + The punch is returned to its normal position after the hole has been punched by a spring.

0

72. O The punch magnet contact is closed by the motor plate.

73. D On a Mechanical Key Punch the power necessary to punch the hole in the card is provided by the punch magnet.

74. + The key on an Electric Key Punch is returned to its normal position by the interposer spring.

75. + Interposer locks or "banjos" prevent the operator depressing two keys at the same time.

76. + Duplicating from the master card may be suppressed after a certain column by setting the rack stop.

77. + When the interposer is depressed by the motor plate the escapement is lifted out of the rack and the dog holds the rack in position while the hole is being punched.

2

72. ___ The punch magnet contact is closed by the motor plate.

73. ___ On a Mechanical Key Punch the power necessary to punch the hole in the card is provided by the punch magnet.

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SORTERS AND SORTER DEVICES

PART 1

MANUAL OF INSTRUCTION
LESSON NO. 8

INTERNATIONAL BUSINESS MACHINES CORPORATION
EDUCATIONAL DEPARTMENT
ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 2—19

SORTERS AND SORTER DEVICES

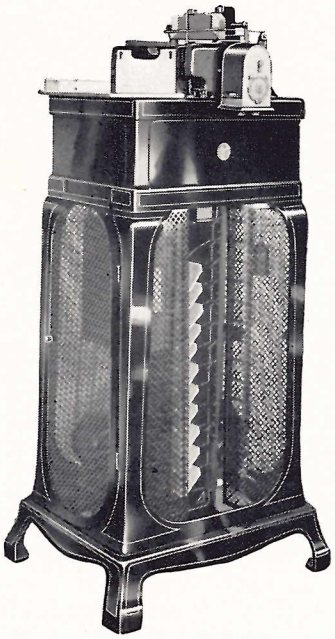
Any accounting system which is based upon the use of a single unit record, whether it be manual or mechanical, necessitates a sorting or classifying operation. International Sorting Machines supply the most speedy and accurate method of arranging groups of cards into any desired classification.

It has been frequently stated that the sorting machine is the heart of any tabulating installation and that without it there would be no widespread commercial application of the punched hole system.

The drudgery of the manual sorting operation is entirely removed and the work is performed far more quickly and accurately than could ever be expected under any other method. International Sorting Machines are fully automatic in operation except for the feeding and removing of cards. It is possible for an operator to load the machine and then continue with some other type of work elsewhere in the office.

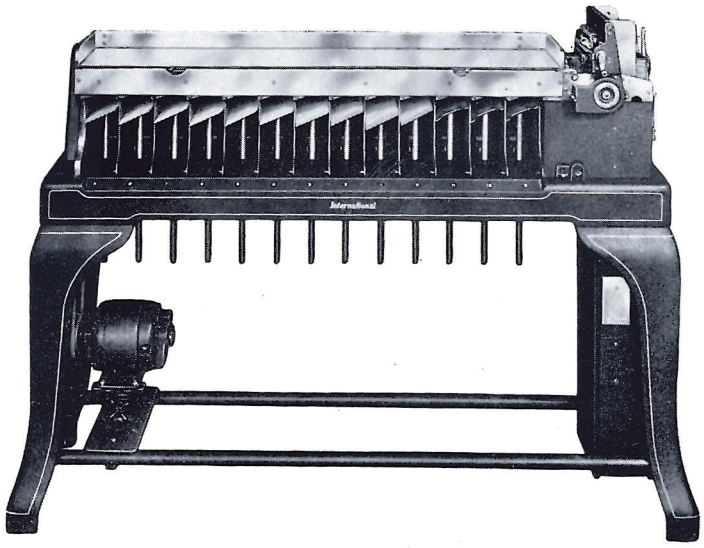
Machines of various styles and speeds are made to meet the individual requirements of our customers. Special problems of the office manager have resulted in the development of special devices which may be attached to the sorting machine, such as the devices for collating, card matching, multiple column selecting, group sorting, and card counting.

The outstanding advantage of the tabulating machine method is the simplicity with which unit records in the form of tabulating cards may be classified and re-classified into any desired classification by means of automatic machines. The job of classifying and re-classifying is the function of the sorter.



Forty-Three Sorter

THE Forty-Three Sorter automatically groups all cards of similar classification and at the same time arranges such classifications in numerical sequence. The operation of this machine is extremely simple; the operator needs only to place the cards in the feed of the machine, set the brush on the column to be sorted, and press the start button. The sorting operation is entirely automatic and is accomplished at the speed of 150 cards per minute.



Type 80 Horizontal Sorter
(Models No. 1 and No. 2)

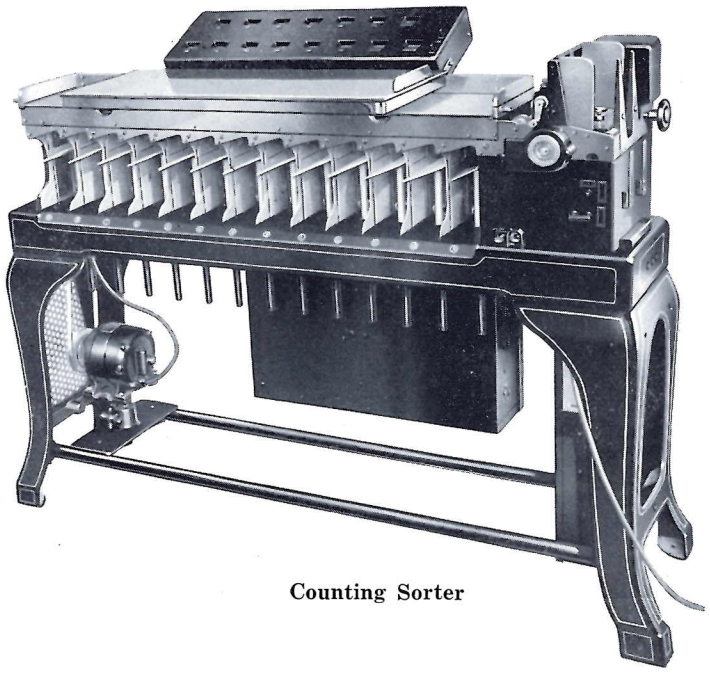
THE Type 80 Horizontal Sorter automatically groups all cards of similar classification and at the same time arranges such classifications in numerical sequence.

It is extremely easy to operate. All the operator has to do is place a group of cards in the feed box, set the sorting brush on the column to be sorted and throw the starting switch. The sorting operation, automatically performed, is accomplished at a speed of 400 cards per minute with the Model No. 1 sorter and 225 cards per minute with the Model No. 2.

Thirteen pockets receive the cards during the sorting operation—one pocket is for the rejected cards (those having no hole in the column being sorted) and each of the other twelve is for one of the twelve punching positions on the card. Each pocket has a capacity for approximately 800 cards and when this limit is reached in any pocket the machine automatically stops, so that the operator may remove them.

A selecting device enables all cards punched with any individual hole or holes in a single column to be sorted out while the remaining cards are passed into the reject pocket without disturbing their sequence.

Throughout the entire design of the horizontal sorter careful consideration has been given to accuracy, speed and quietness of operation.



Counting Sorter

THE Counting Sorter is designed for the purpose of simultaneously counting and classifying punched tabulating cards. It is also capable of operating as a regular sorter, without counting, or as a counting mechanism, without sorting.

The sorting mechanism has thirteen pockets into which the cards fall during the sorting operation. One is for rejected cards (those having no holes in the column being sorted); the other twelve are for the twelve punching positions in a card column. Each pocket has an 800 card capacity. When this limit is reached in any one pocket, the machine automatically stops to enable the operator to remove the cards.

The adjustable counting mechanism, which will count as many holes as are punched in any one card column, is equipped with fifteen adding counters, one for each of the twelve conditions that can be recorded in a column, one for unpunched cards, one for sub-totals, and one for grand totals. All counters can be cleared in a single operation, or the grand total counter may be allowed to accumulate. Each counter has a 5 digit capacity.

A selecting device enables all cards punched with any particular hole or holes in a single column to be sorted out; the remaining cards pass into the reject pocket without any change in their sequence.

The counting mechanism is located directly behind and above the top of the machine. This makes the figures in the counters readily visible to the operator and a reading board on top of the machine provides a convenient place for transcribing the data.

Throughout the entire design of the Counting Sorter careful consideration has been given to accuracy, speed, quietness, and convenience of operation.

CARD MATCHING DEVICE

The card matching device is an attachment for the horizontal sorting machine which is used to select matched cards from a group of cards by means of contrasting corner cuts.

The regular brush holder is replaced by a special brush which operates on either the extreme left or the extreme right of the card. Cards having a corner cut are sorted into the 12 pocket. Square cornered cards are sorted into the 12 pocket when they follow cards with a corner cut, but are rejected when they follow other square cornered cards.

One example of operation is the selection of a master card for each group of detail cards from a complete master card file. In this case the complete file of master cards may be sorted in behind the detail cards in the sort to groups. This is followed by an additional sort for matching purposes in which all master cards, except those directly following detail cards, are eliminated.

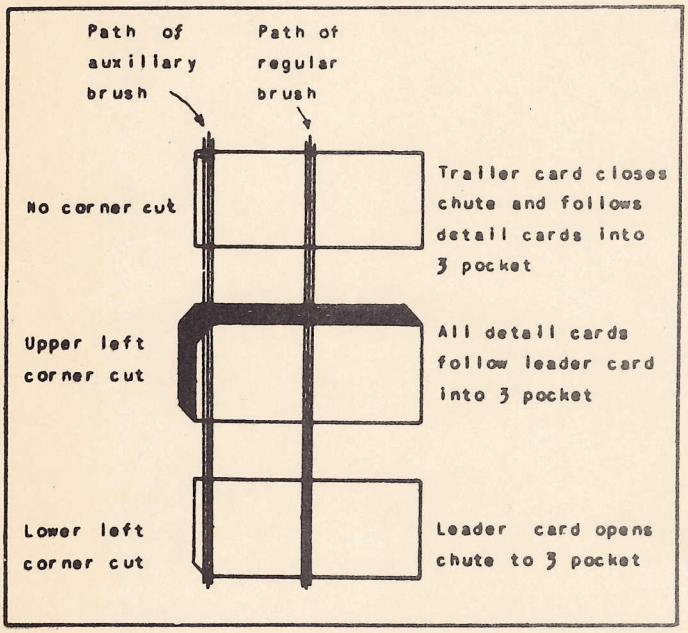
If it is desired to have the master cards precede the detail cards, the normal operation of the device is reversed by using a brush offset to the other side and feeding the cards face up.

The card matching device should not be placed on machines which are already equipped with a multiple column selecting device.

GROUP SORTING DEVICE

The group sorting device is an attachment for horizontal sorting machines that causes the sorting of an entire group of cards to be controlled by the punching in a "leader" master card which precedes the group, irrespective of the punching of the detail cards. A "trailer" card is also essential to the operation.

The accompanying illustration shows how the leader card determines the pocket into which the detail cards will be sorted even though they are punched differently in the column being sorted. The trailer card prepares the machine for the next group. A special brush, permanently mounted on the outside rail, distinguishes between the kinds of cards by means of corner cuts, as illustrated.


Path of auxiliary brush
Path of regular brush
No corner cut
Trailer card closes chute and follows detail cards into 3 pocket
Upper left corner cut
All detail cards follow leader card into 3 pocket
Lower left corner cut
Leader card opens chute to 3 pocket

The use of the group sorting device does not affect the speed of the machine or its operation for other work. A switch is provided to render the device inoperative.

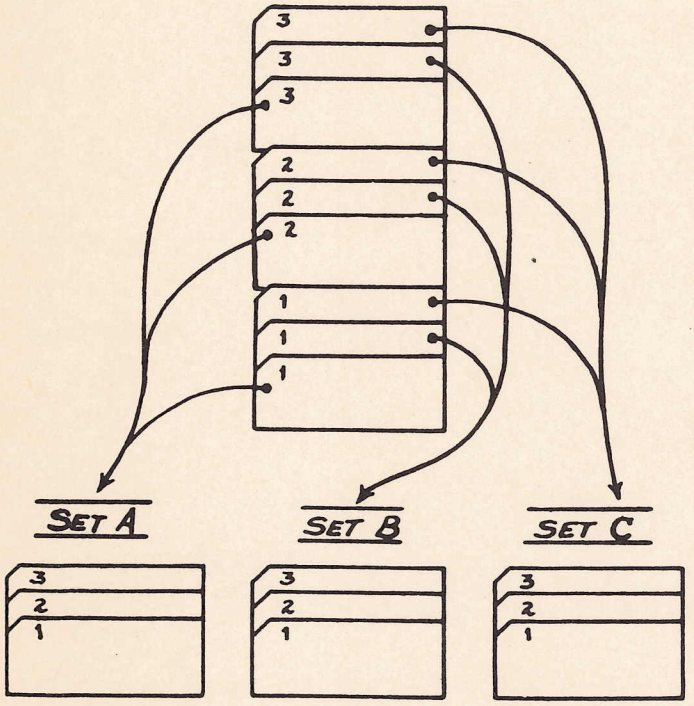
The group sorting device may be used to eliminate certain coding, punching, and verifying of detail cards. For example, in cost accounting work, a master card may be punched with job number, department, and account, while only job number is punched in the detail cards.

At the end of the accounting period, both the master and detail cards can be sorted to job number in the regular way. Then the group sorting device may be used to bring the charges together by departments and accounts for cost tabulations.

COLLATING DEVICE

The horizontal sorting machine can be equipped with a collating device which will prepare sets of cards without requiring any identifying punching.

A number of cards of each kind exactly equal to the number of sets required are placed in the hopper of the sorting machine. The sorting brush is raised so that it does not touch the cards.

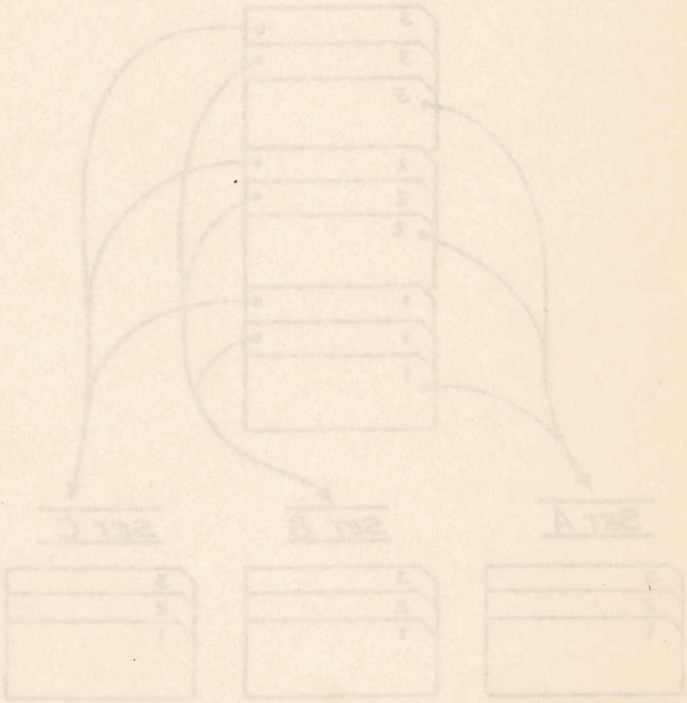


The collating device switch is then turned "on". This causes the chutes to the pockets to open in rotation so that one card of each kind is distributed to each pocket.

The device can be adjusted by means of switches (which must be specified) to prepare from two to twelve sets at one time. Any number of sets may be made by multiple runs.

The installation of this device does not affect the speed of the sorting machine or its normal operation.

This attachment can be used to advantage in an application such as payroll, where daily cards are gang-punched in advance for each employee for every day in a pay period. The device takes these cards, in employee order, and prepares a separate set for each day containing one card for each employee.



MULTIPLE COLUMN SELECTING DEVICE

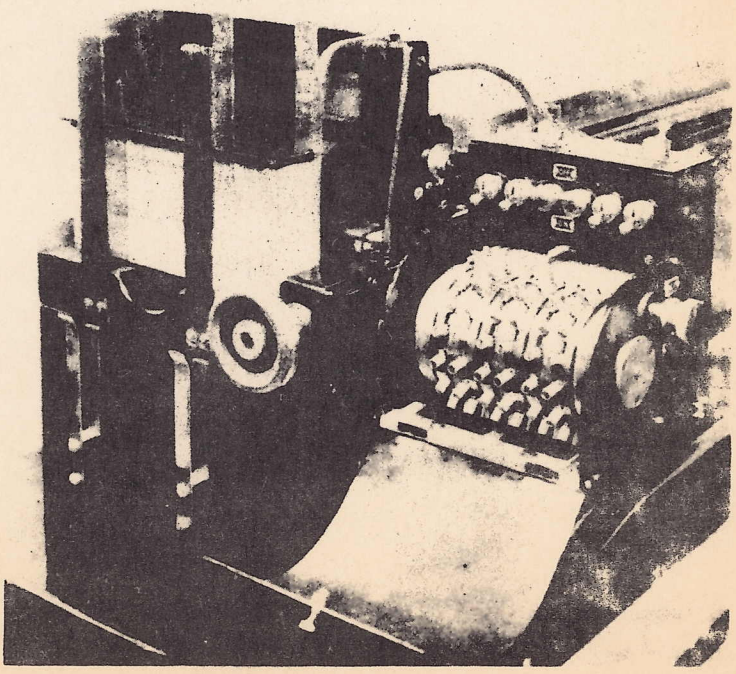
The multiple column selecting device is an attachment for the horizontal sorting machine which permits the selection of all cards punched with a predetermined number or group of consecutive numbers without in any way disturbing the sequence of the remaining cards in the pack. Sorting cannot be performed in combination with selecting.

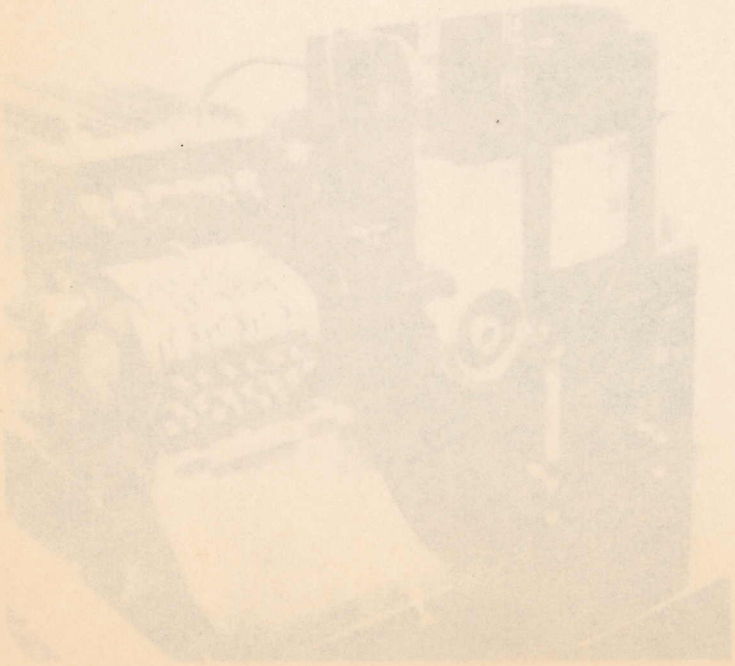
In the use of this device, the regular sorting brush holder is replaced by a special multiple brush holder with six brushes, which can be set on any six adjacent columns. The following types of selection can be made in one run:

1. Any single number of from one to six digits. Only those cards punched with the specific set number are selected.
2. Certain combinations of successive numbers, such as (a) 473980 to 473989 (or 473983 to 473986) where all digits but those in the units position are common. Any desired numbers in the units position can be selected; (b) 473900 to 473999 (or 473960 to 473989) where all digits but those in the units and tens positions are common.

Combinations outlined in (a) and (b) can be extended to all digit positions provided it is borne in mind that all possible combinations of numbers, according to the buttons set, will always be selected. For example, it is possible to select 2700 to 2899 but impossible to select 2700 to 3899, as all numbers from 2000 to 2699 and 3900 to 3999 would be erroneously included.

The operation of the multiple column selecting device does not affect the operating speed of the sorting machine, and it may be disconnected when the sorter is used for other work.





SORTERS AND SORTER DEVICES

PART 2

MANUAL OF INSTRUCTION
LESSON NO. 9

INTERNATIONAL BUSINESS MACHINES CORPORATION
EDUCATIONAL DEPARTMENT
ENDICOTT, N. Y.

PRINTED IN U. S. A. FORM 2—19—1

Type 75 45 Column capac. 150 card min 12 pockets
120 AC or DC.

Type 80
80

Model I 400 cpm. } 13 pockets
Model II 225 cpm } 1 rejects unpunched.
120-210 DC with AC Drive

Commutater enables operator
To suppress sorting of ones

Model 78

Model I 400
Model II 225
80-45 Column
13 pockets 12 punch 1 reject.
Counts & sorts.
Counts without sorting.
15 counters. 5 Digits

12 for 12 posi.
1 " rejects
1 " sub totals
1 " grand total
release all cept grand total.

HORIZONTAL SORTER

GENERAL

The punched cards are fed into this machine horizontally from a magazine and are electrically arranged into any desired relationship. There are thirteen pockets in the machine, twelve of which are for the corresponding position in each column of the card.

Any desired cards may be automatically selected from a group and placed in their corresponding pockets, while the remaining cards will be placed in the extra or "R" pocket without disturbing their original relationship.

SPEED

This machine is designed to operate at a speed of 360 to 400 cards per minute, and must not under any circumstances be operated in excess of 400 cards per minute.

CAPACITY

Each card pocket holds approximately 800 cards. However it is well not to allow more cards to accumulate in any pocket than can be conveniently removed with one hand. The feeding magazine has a card capacity of approximately 900 cards and it can be fed continuously.

OPERATION

To set the brush in position for sorting any given column on the card, revolve the operating handle (Fig. 17) until the pointer is opposite the number corresponding to the column on which the cards are to be sorted. Next place the punched cards face down in the magazine (printed side down) with the top edge toward the card knives and put the pressure weight on. If it is desired to sort all positions on the card from 9 to 12 inclusive (regular sorting) all the commutator switches must be as shown in Fig. 1. Should it be desired to sort or select any one or more numerals in a given column it will be necessary to pull down ALL commutator switches EXCEPT those corresponding to the positions to be selected. Fig. 2 illustrates the commutator with the switches arranged to select the 6-3-0 positions, which will be sorted into their corresponding pockets, the remaining cards sorting into the "R" pocket in their original sequence.

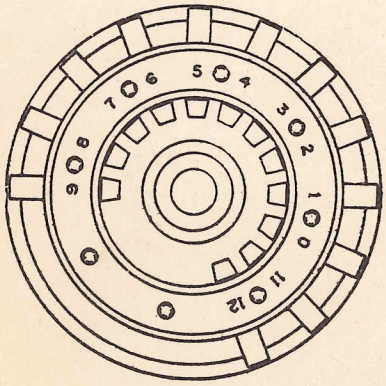


Fig. 1

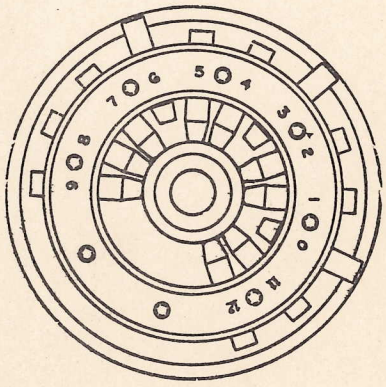


Fig. 2

PRINCIPLE OF HORIZONTAL SORTING

The principle upon which this machine operates is as follows: Cards are fed horizontally from a magazine and pass directly under the card brush A and over the brass roll B. Assuming that the card C is punched "4" it will have traveled under the 9. 8, 7, 6 and 5 chute blades as shown in Fig. 3. The brush makes contact completing the selecting circuit The sorting magnet D thus becomes energized attracting the armature E, and the 4, 3, 2, 1, 0, 11, and 12 chute blades follow down with the armature E thus creating an opening between the 5 and 4 chute blades (see Fig. 4), through which the card is conveyed by carrier rolls to its respective pocket. If a blank or unpunched card is fed into the machine the brush A fails to make contact with the brass roll B; therefore the sorting magnet D does not receive an impulse and the armature E will not pull down. Consequently, the card in this case is carried into the "R" pocket.

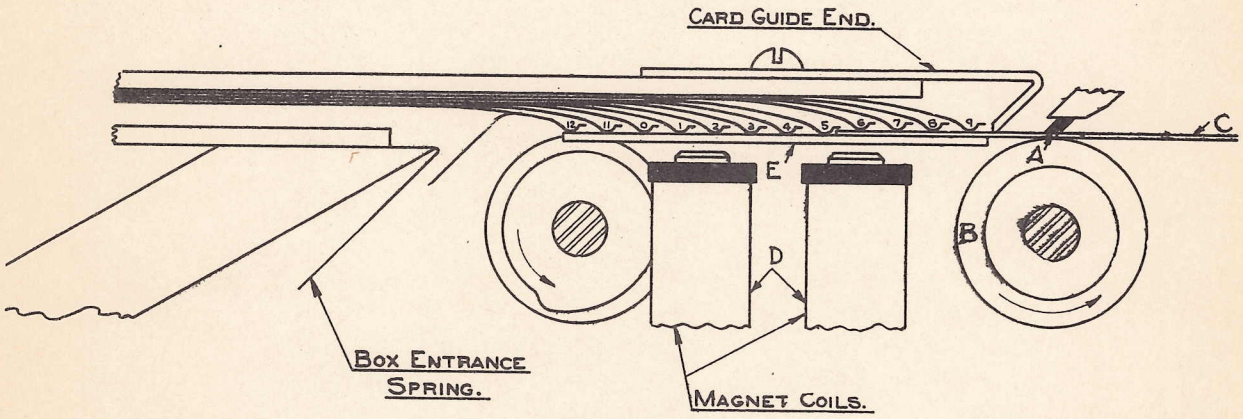


Fig. 3

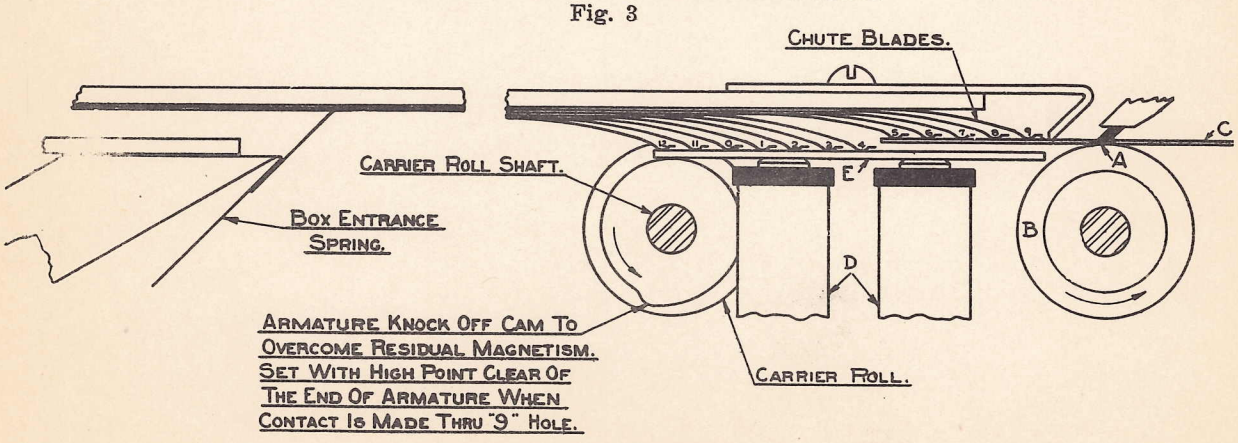
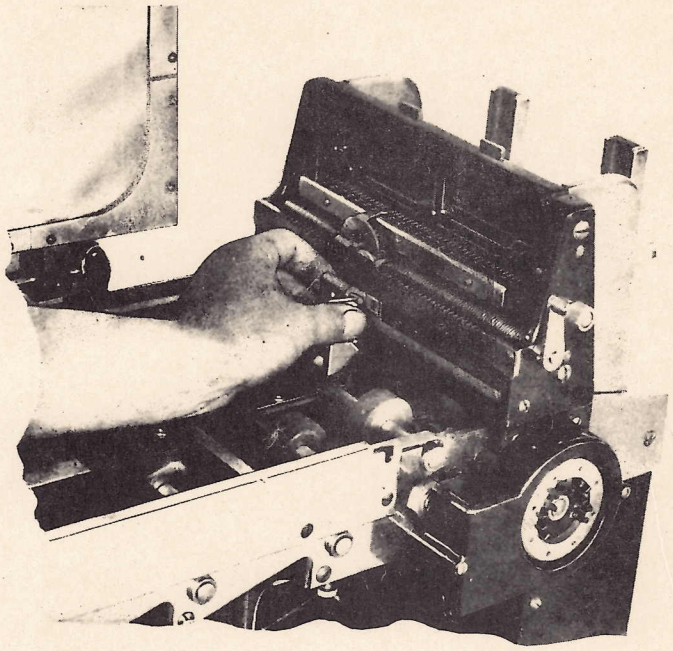

CHUTE BLADES.
C
A
CARRIER ROLL SHAFT.
E
B
BOX ENTRANCE SPRING.
D
ARMATURE KNOCK OFF CAM TO OVERCOME RESIDUAL MAGNETISM. SET WITH HIGH POINT CLEAR OF THE END OF ARMATURE WHEN CONTACT IS MADE THRU "9" HOLE.
CARRIER ROLL.

Fig. 4

THE CARD BRUSH

To insert a new card brush, raise the operating handle one-half turn until it is directly opposite from its normal position.



This has raised the brush holder from the brass contact roll. The brush holder locking lever (see Fig. 5) can now be raised to the position shown and the brush holder assembly removed. Next loosen the brush retaining screw and pull out the defective card brush.

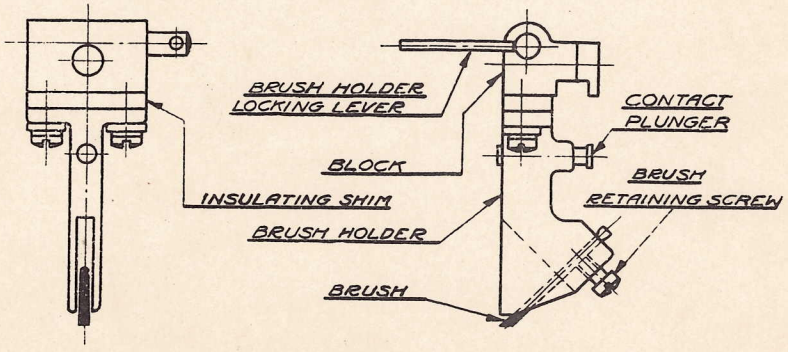
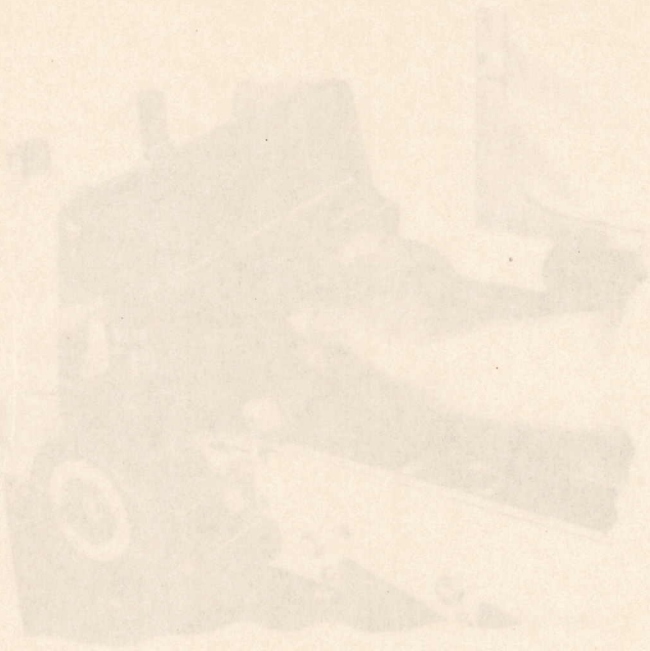
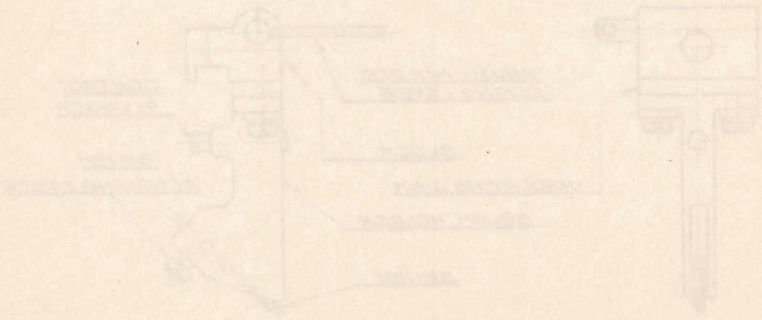


Fig. 5





When a new brush is inserted it must be timed in the following manner: Feed a card punched "8" by hand until the card brush makes contact through the punched hole. When the contact is made the end of the 9 chute blade should overlap the card 1/64" to 1/32" maximum (see A Fig. 6). There must not be less than 1/64" overlap of the chute blade on the card when turning the machine by hand. With the card brush in this position the commutator should be set so that its inner brush is making full contact on the 8 segement. (See B Fig. 6.) When replacing the brush holder assembly follow the above instructions in the reverse order. Do not lower the handle and allow the brush to touch the brass roll until the brush holder is clamped in place.

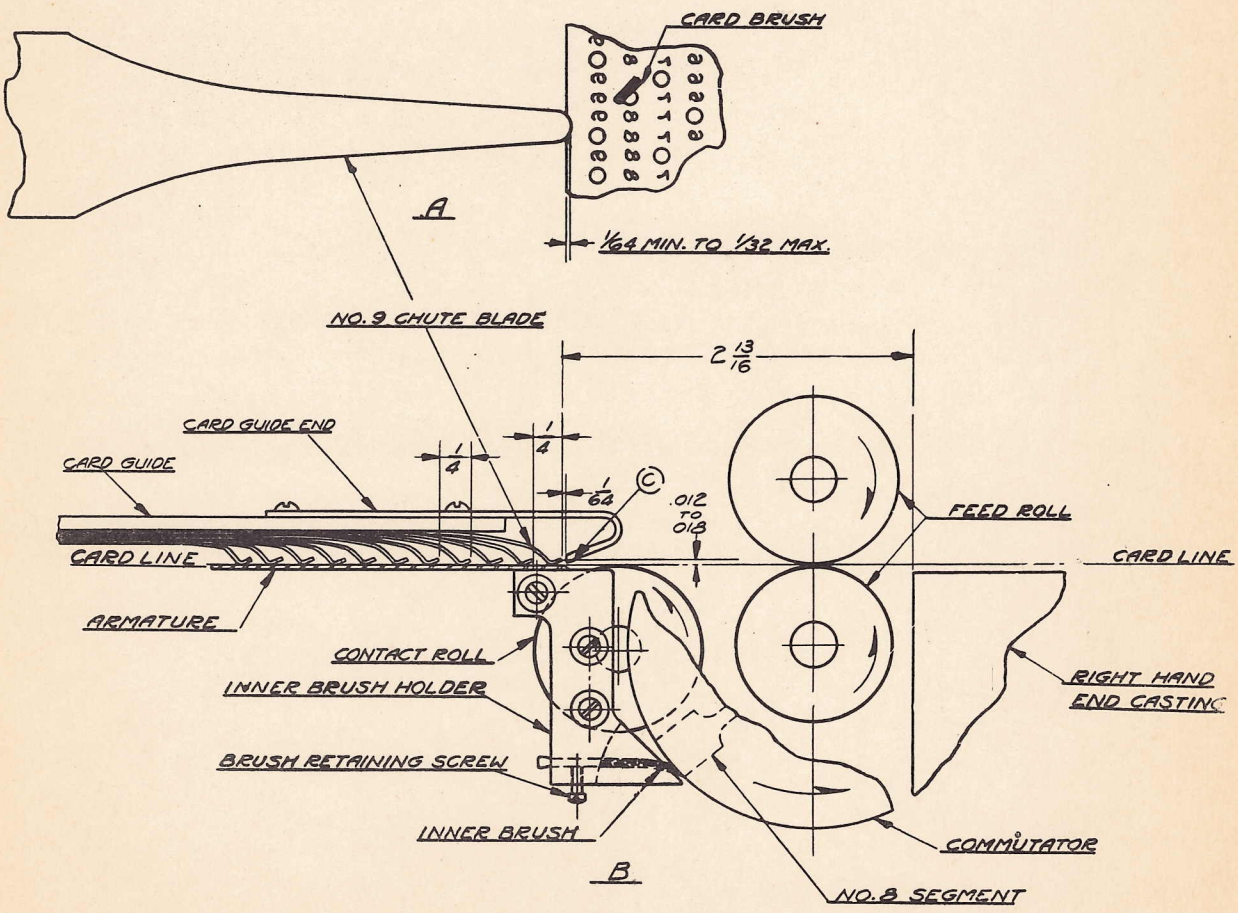
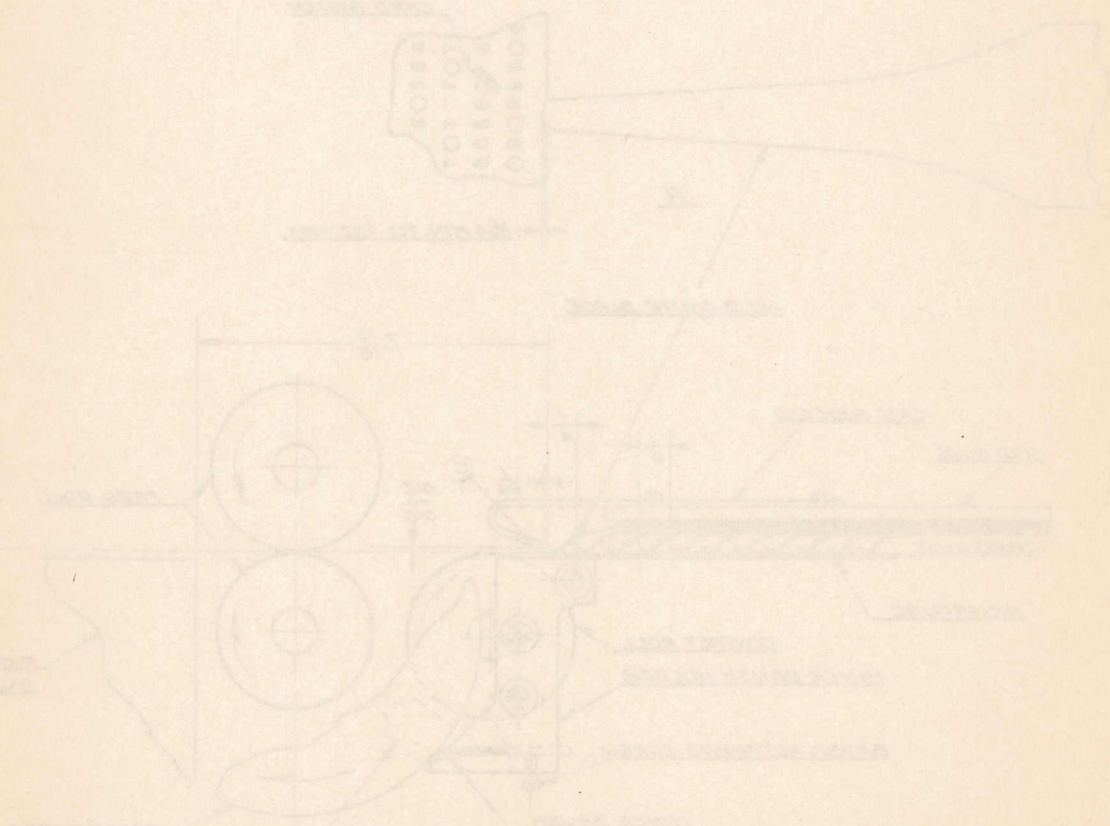


Fig. 6



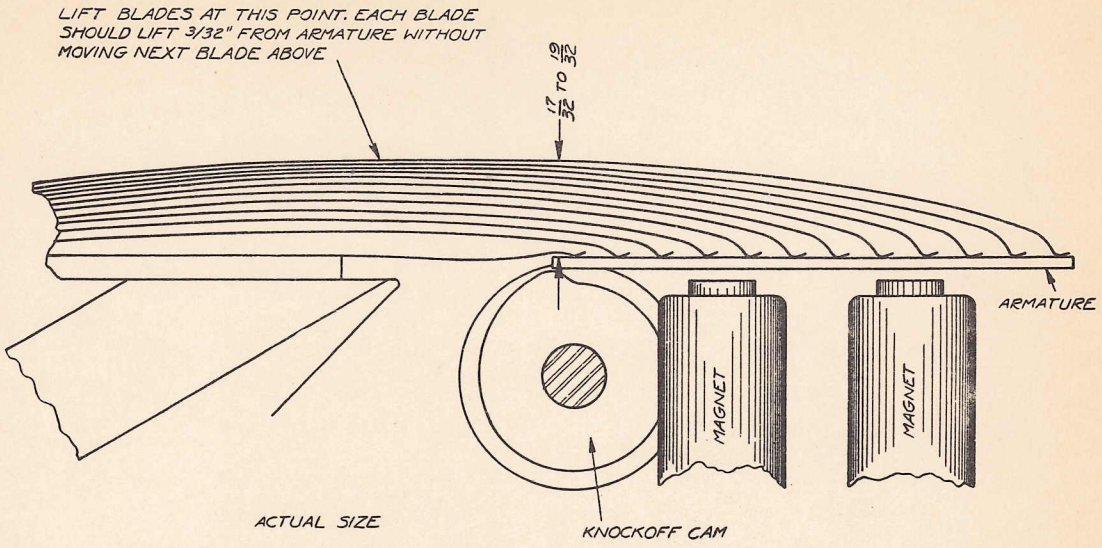
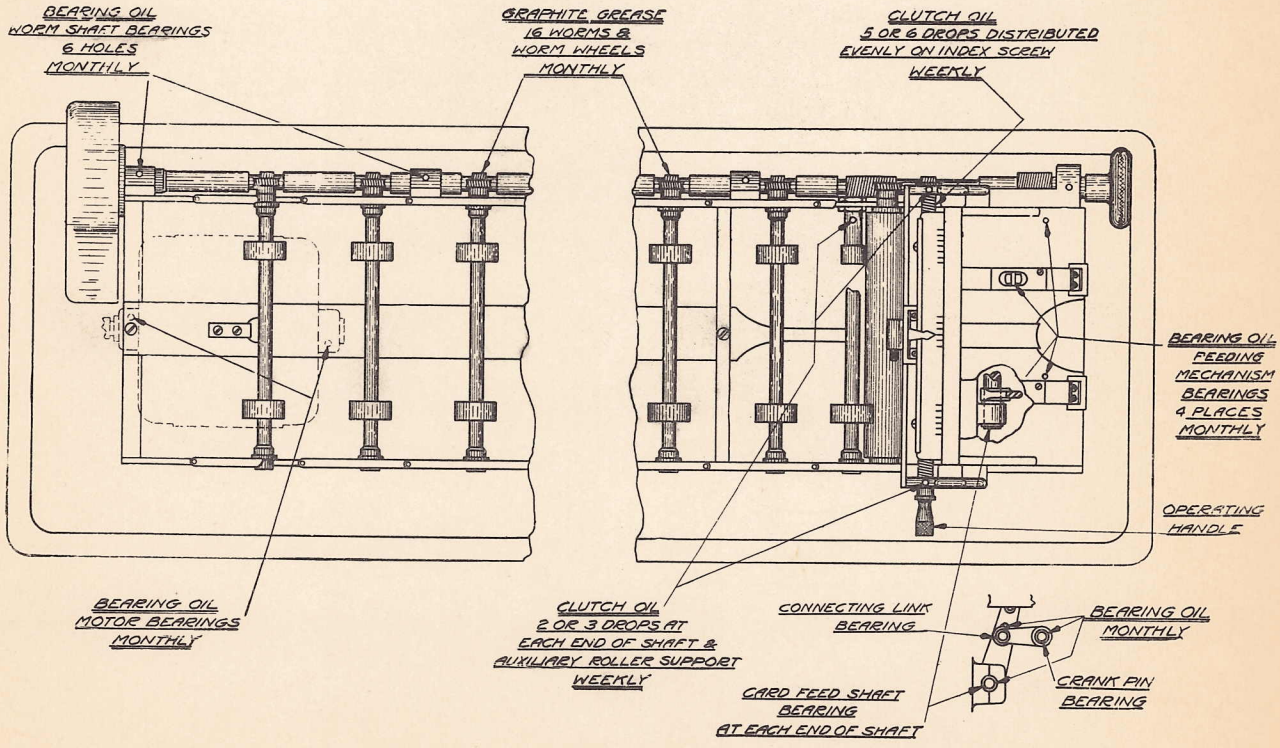
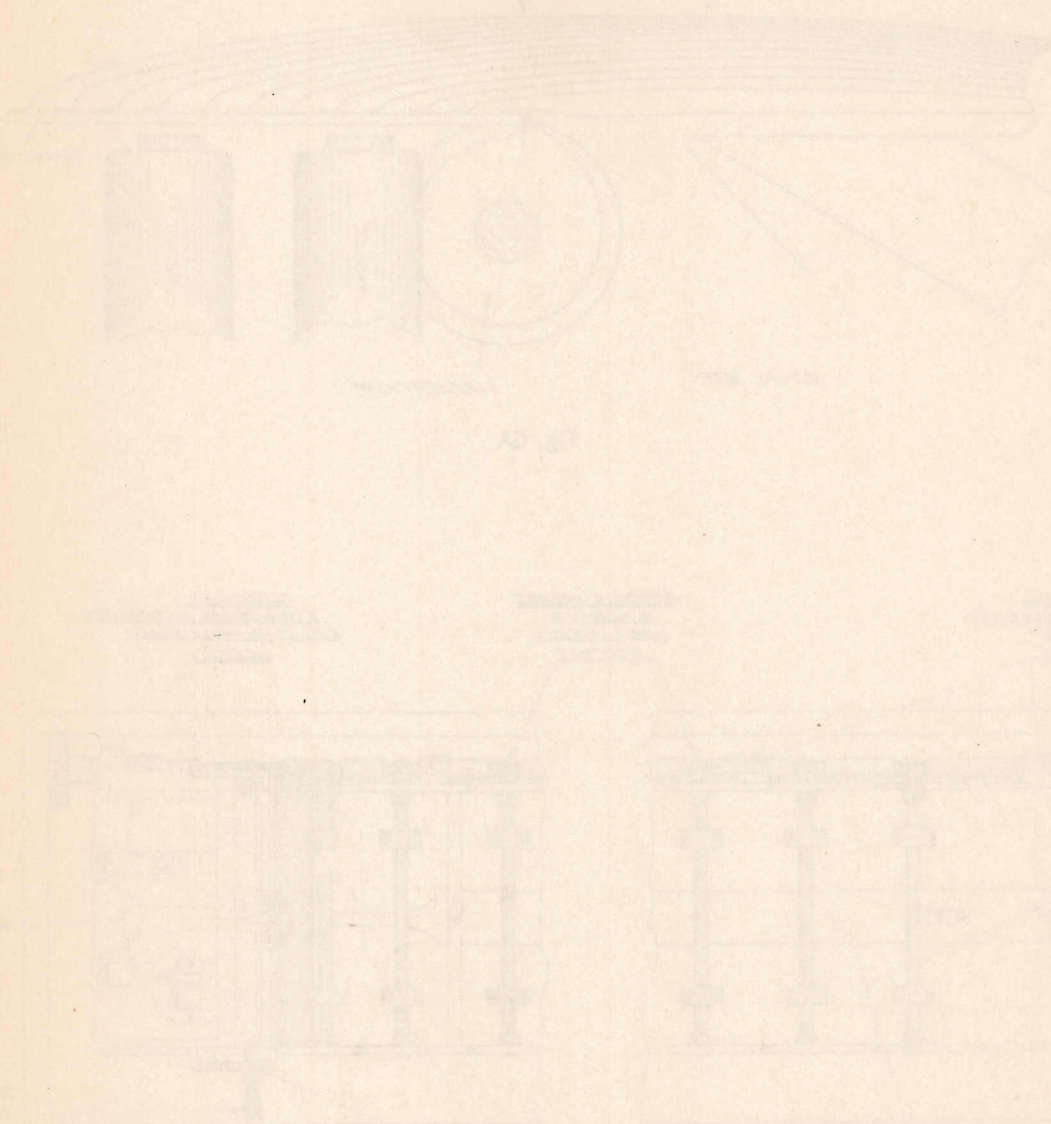

LIFT BLADES AT THIS POINT. EACH BLADE SHOULD LIFT 3/32" FROM ARMATURE WITHOUT MOVING NEXT BLADE ABOVE
17/32 TO 19/32
ARMATURE
MAGNET
MAGNET
ACTUAL SIZE
KNOCKOFF CAM

Fig. 6A


BEARING OIL WORM SHAFT BEARINGS 6 HOLES MONTHLY
GRAPHITE GREASE 16 WORMS & WORM WHEELS MONTHLY
CLUTCH OIL 5 OR 6 DROPS DISTRIBUTED EVENLY ON INDEX SCREW WEEKLY
BEARING OIL FEEDING MECHANISM BEARINGS 4 PLACES MONTHLY
OPERATING HANDLE
BEARING OIL MOTOR BEARINGS MONTHLY
CLUTCH OIL 2 OR 3 DROPS AT EACH END OF SHAFT & AUXILIARY ROLLER SUPPORT WEEKLY
CONNECTING LINK BEARING
BEARING OIL MONTHLY
CRANK PIN BEARING
CARD FEED SHAFT BEARING AT EACH END OF SHAFT



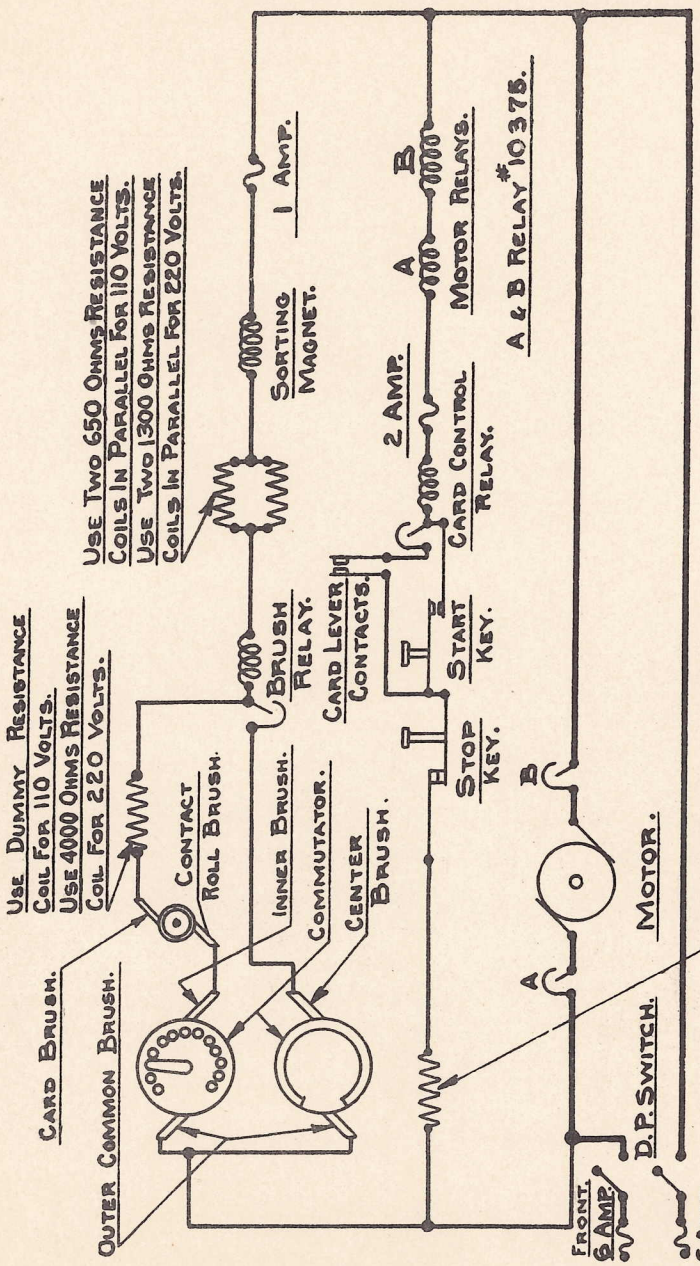

Use Dummy Resistance
Coil For 110 Volts.
Use 4000 Ohms Resistance
Coil For 220 Volts.
Use Two 650 Ohms Resistance
Coils In Parallel For 110 Volts.
Use Two 1300 Ohms Resistance
Coils In Parallel For 220 Volts.
Card Brush.
Contact
Roll Brush.
Outer Common Brush.
Inner Brush.
Commutator.
Center
Brush.
Brush
Relay.
Sorting
Magnet.
1 Amp.
Card Lever
Contacts.
2 Amp.
A
B
Stop
Key.
Start
Key.
Card Control
Relay.
Motor Relays.
A & B Relay #10375.
A
B
Motor.
Front.
6 Amp.
D.P. Switch.
6 Amp.
Rear.
Use Dummy Resistance
Coil For 110 Volts.
Use 1200 Ohms Resistance
Coil For 220 Volts.

Fig. 10

SORTERS AND SORTER DEVICES

PART 3

110 DC/Horizontal 14.5 to start Run 3.4 A Mg. .3 AMP
110 AC Start 18 Amp. Run. 5 AMP
220 DC 8 Amp Start 1.8 Run.
220 AC 10 Amp Start 2.8 Run.

MANUAL OF INSTRUCTION
LESSON NO. 10

INTERNATIONAL BUSINESS MACHINES CORPORATION
EDUCATIONAL DEPARTMENT
ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 2—19—2

FACTS TO KNOW ABOUT SORTERS

1. WHAT IS THE PURPOSE OF THE SORTER?

   To arrange cards according to numerical sequence or other predetermined groupings.

2. ON WHAT TYPE OF CURRENT DOES THE SORTER OPERATE? WHAT VOLTAGE?

   Type 83 is furnished to operate either on alternating or direct current - 110 or 220 volts. Horizontal sorters operate on direct current only - 110 or 220 volts. (Although the drive mechanism may be actuated by an AC motor.)

3. WHAT IS THE TYPE OF FEED?

   Type 83 has a vertical feed. Horizontal sorters have a continuous horizontal feed.

4. WHAT IS THE SPEED PER MINUTE?

   Type 83 operates at a speed of 150 cards per minute; horizontal sorters at 400 cards per minute.

5. WHAT DIFFICULTIES MAY BE CAUSED BY A SPREAD BRUSH?

   A spread brush may cause the cards to be sorted into the wrong pockets.

6. HOW MANY CARD POCKETS HAS THE MACHINE?

   Type 83 has 12 pockets; the horizontal sorter, 13.

7. IS THE SORTER EQUIPPED WITH AUTOMATIC POCKET STOPS?

   Only the horizontal sorter.

8. HOW CAN ONE CHECK THE SORTING?

   By holding the sorted cards up to the light and sighting through the punched holes.

9. ARE ALL SORTING MACHINES EQUIPPED FOR SELECTIVE SORTING?

   Only the horizontal sorter is equipped for selective sorting.

10. IF IT IS DESIRED TO SELECT ONLY THE CARDS PUNCHED '6' IN A GIVEN COLUMN AND RETAIN THE REMAINING CARDS IN THEIR ORIGINAL SEQUENCE, HOW ARE THE SELECTOR SWITCHES SET? INTO WHAT POCKET DO THE UNSELECTED CARDS FALL?

    The small switch corresponding to the '6' position remains at the outer position; all others are pushed toward the center.

    The unselected cards fall into the "R" pocket.

11. WHAT IS THE PURPOSE OF THE MULTIPLE COLUMN SELECTING DEVICE?

To separate all cards punched with a predetermined number or group of consecutive numbers from a file of cards without in any way disturbing the sequence of the remainder of the cards in the pack.

12. WHAT IS THE MAXIMUM NUMBER OF DIGITS IN A NUMBER THAT MAY BE SELECTED BY THE MULTIPLE COLUMN SELECTING DEVICE?

Six.

13. HOW WOULD YOU PROCEED TO SELECT CARDS PUNCHED 125, 126 AND 128?

(1) Set switches 5, 6, and 8 in the units column
(2) Set the 2 switch in the tens column
(3) Set the 1 switch in the hundred column
(4) Make sure all other number switches are OFF
(5) Turn on the three control switches corresponding to the columns set
(6) Replace the regular brush holder by the multiple brush assembly
(7) Turn on the switches on top of the device
(8) Close the cover door
(9) Set the knurled knob on the rear to ON

14. WHAT IS THE PURPOSE OF THE CARD MATCHING DEVICE?

To select matched cards from a group of cards by means of contrasting corner cuts.

15. WHAT ARRANGEMENT OF THE CARDS IS NECESSARY FOR THE FUNCTIONING OF THE CARD MATCHING DEVICE?

The cards must first be sorted so that the detail cards (corner cut cards) for each code number precede the master card (square corner cut card) for that group.

16. WILL THE CARD MATCHING DEVICE MATCH MORE THAN ONE DETAIL CARD WITH A MASTER CARD? IF SO, UNDER WHAT CONDITIONS?

Yes, provided all the detail cards are corner cut cards, and only one master or square corner card appears in the group.

17. HOW WOULD YOU SORT A FOUR COLUMN FIELD TO PLACE THE CARDS IN NUMERICAL SEQUENCE (3,000 CARDS).

The cards must be run through the sorter four times - beginning with the units column and following with the tens, hundreds, and thousands columns in succession.

18. A REPORT INVOLVING 100,000 CARDS TO BE SORTED IN A FIVE COLUMN FIELD IS DESIRED AS SOON AS POSSIBLE. HOW WOULD YOU SORT THE CARDS?

Break the block of cards down into ten groups which can be conveniently handled, by sorting the first column at the left, (ten thousands column) and then sort each group as described in the previous question.

19. THREE THOUSAND CARDS ARE PUNCHED AS FOLLOWS:

EMPLOYEE NUMBER.....COLUMNS 17 - 20
DEPARTMENT NUMBER.....COLUMNS 21 - 22
ORDER NUMBER.....COLUMNS 23 - 27
PART NUMBER.....COLUMNS 28 - 32
OPERATION NUMBER.....COLUMNS 33 - 34

FIVE TABULATIONS ARE DESIRED AS FOLLOWS:

(a) EMPLOYEE NUMBER
(b) PART NUMBER SUBDIVIDED BY OPERATION NUMBER
(c) OPERATION NUMBER SUBDIVIDED BY EMPLOYEE NUMBER
(d) DEPARTMENT NUMBER SUBDIVIDED BY ORDER NUMBER
(e) ORDER NUMBER SUBDIVIDED BY PART NUMBER

IN WHAT SEQUENCE SHOULD THESE REPORTS BE MADE IN ORDER TO REDUCE SORTING TO A MINIMUM?

a, c, b, e, d,

20. TWO THOUSAND CARDS ARE PUNCHED AS FOLLOWS:

CUSTOMER.....COLUMNS 18 - 19
TOWN.....COLUMNS 20 - 22
STATE.....COLUMNS 23 - 24

WHAT COLUMN SEQUENCE SHOULD THE SORTING FOLLOW IN ORDER TO OBTAIN A TABULATION OF EACH STATE SUBDIVIDED BY TOWN AND EACH TOWN SUBDIVIDED BY CUSTOMER?

19, 18, 22, 21, 20, 24, 23.

21. WHAT IS THE PURPOSE OF THE COUNTING SORTER (NON-PRINTING)?

To simultaneously classify and count punched tabulating cards.

22. AT WHAT SPEED DOES THIS MACHINE OPERATE PER MINUTE?

Four hundred cards per minute.

23. HOW MANY COUNTERS HAS IT?

Fifteen

24. HOW MANY COUNTING WHEELS IN EACH COUNTER?

Five.

25. WHICH COUNTERS CLEAR IN UNISON AND WHICH CLEAR SEPARATELY?

All except the grand total counter can be cleared in one operation or by throwing in a clutch all counters may be cleared together.

-o-

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

EXAMINATION -

SORTERS

INSTRUCTIONS

If a statement is false, place a zero (0) on the line to the left; if a statement is true, place a plus sign (+) on the line to the left. DO NOT GUESS. MISTAKES ARE TWICE AS COSTLY AS OMISSIONS.

Frank Lucas
NAME

13

75016
CLOCK NO.

78
GRADE

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

EXAMINATION -

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NAME

CLOCK NO.

GRADE

SORTER EXAMINATION

1. — The following sorters have the type numbers as given:
   Vertical Sorter Type 71
   Horizontal Sorter Type 85
   Card Counting Sorter Type 75

2. + The vertical sorter is made only in the 45 column capacity.

3. + The horizontal sorter and card counting sorter are made both in the 45 and 80 column capacity.

4. — The speed of the vertical sorter is 225 cards per minute.

5. — The speed of the horizontal sorter Model 1 is 225 and the Model 2, 400 cards per minute.

6. + — There are 12 pockets in the vertical sorter, each having a capacity of 80 cards.

7. + The horizontal sorter has 13 pockets, each having a eapacity of 800 cards.

8. — All damaged cards go into the reject pocket.

9. — When a damaged card is fed into the machine the pocket stop mechanism operates to stop the machine to prevent a jam.

10. — All sorters are equipped with a pocket stop mechanism.

11. + The vertical sorter will operate on either A.C. or D.C., 110 or 220 volts.

12. + The horizontal sorter will operate only on direct current 110 or 220 volts, or a combination of alternating and direct current.

13. — The starting current of a horizontal sorter is approximately 2 amperes

14. — There are 14 counters on the card counting sorter.

15. — The purpose of the card counting mechanism on the card counting sorter is to add the amounts punched in any given field in the card.

16. + The purpose of the commutator is to allow the operator to set the machine to sort only certain numbers punched in the column being sorted.

17. + — Four sorts would be necessary to place the following names in alphabetical sequence on the alphabetic sorter:
   Smith
   Jackson
   Jones
   Brown
   Kelly

18. — Seven sorts are necessary to put a numerical field of six columns in sequence on the vertical sorter.

19. + Cards are placed in the horizontal sorter face down with the bottom edge toward the machine.

20. — All sorters have two selector brushes for sorting.

21. + The sequence of operations necessary to place a stack of cards in man order sequence when man number is punched in columns 4, 5, and 6, are as follows:

1. Place cards in horizontal sorter face down with bottom edge toward the machine.
2. Set selector brush to column 6, and depress start key.
3. After all the cards have gone through the machine, take the cards out of pocket "0" first, keeping them face down, put the cards from pocket "1" on top of them face down, etc., until all the cards are out of the machine.
4. Place the cards in the machine face down as above and set the selector brush to column 5 and depress the start key.
5. When the sort is complete, remove the cards in the same manner as described above and repeat the operation with the selector brush in column 4.
6. Remove the cards as before. The cards are now in man number sequence.

22. — If a card is double punched, the horizontal sorter will jam when it is fed into the machine.

23. — Unpunched cards will go into the "12" pocket on the horizontal sorter.

24. + If the selector brush on a horizontal sorter is spread, missorting will result. This condition is remedied by replacing the defective brush.

25. + Cards can be fed into the horizontal sorter by hand by turning the knurled wheel at the feed end of the machine.

26. — The horizontal sorter must be stopped if the operator wishes to put additional cards in the machine.

27. + If a set of cards in man number sequence are again sorted on order number, each order group will be in man number sequence.

28. — The card matching device is standard equipment on horizontal sorters.

29. + It is necessary before the cards and "dummies" are to be matched by the card matching device to sort the cards and "dummies" on a field common to both.

30. —+ The master or "dummy" cards with no corner cut should precede the detail cards with corner cut in the sorting operation.

31. —+ The matched cards go into the reject pocket and the unmatched cards, or cards without mate, go into the "12" pocket.

32. — The regular selector brush may be used with the card matching device.

33. +— When card matching, the brush is set so that it will read in the margin at either end of the card.

20. ____ All sorters have two selector brushes for sorting.

21. ____ The sequence of operations necessary to place a stack of cards in man order sequence when man number is punched in columns 4, 5, and 6, are as follows:

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32. ____ The regular selector brush may be used with the card matching device.

33. ____ When card matching, the brush is set so that it will read in the margin at either end of the card.

34. 0 + Group sorting is used to select a certain card or similar punched cards from a group.

35. + − It is necessary to sort the master cards with the detail cards previous to using the group sorting feature.

36. + There are two methods of group sorting, the single master card method and the double master card method.

37. − The master cards always follow the detail cards in the hopper when sorting the two together previous to group sorting.

38. + There are two brushes used when group sorting, a selector brush, and an auxiliary brush.

39. + The collating device is used to make up sets of cards.

40. 0 + A special offset brush is necessary when using the collating device.

41. 0 + Since there are only 13 pockets on the sorter only 13 decks can be made on one sort, but by multiple runs any number may be made.

42. + − The number of cards of each kind from which decks are to be made must equal the number decks.

43. − The collating device is a standard feature only on the card counting sorter.

44. + The multiple-column selection device is used to select a certain card or group of cards from a group without disturbing the sequence.

45. 0 + The cards must be sorted in proper sequence before the multiple column selection device can be used.

46. + The selected card or group of cards will go into the reject pocket while all the other cards in the group will go into the "12" pocket.

47. + A special selector brush holder with 6 brushes is necessary when using the multiple column selection device.

48. − Man number is punched in columns 15, 16, and 18. Department number is punched in 31 and 32. Since we are selecting on a total of 5 columns, only one sort is necessary to select any certain card.

49. Three thousand cards are punched as follows:

Employee number, columns 17-20
Department number, columns 21-22
Order number, columns 23-27
Part number, columns 28-32
Operation number, columns 33-34

Five tabulations are desired as follows:

a. Employee number
b. Part number subdivided by operation number.
c. Operation number subdivided by employee number
d. Department number subdivided by order number
e. Order number subdivided by part number

a c b e d

(Continued next page)

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Five tabulations are desired as follows:
a. Employee number
b. Part number subdivided by operation number.
c. Operation number subdivided by employee number
d. Department number subdivided by order number
e. Order number subdivided by part number

(Continued next page)

If the first tabulation is to be (a), in what sequence should these reports be made in order to reduce sorting to a minimum?

50. + The digit capacity of the counters in the card counting sorter is five.

MECHANICS OF THE SORTER

51. + The card feed knives feed the cards from the bottom of the stack in the hopper to the first feed roll.

52. − The steel feed rolls are run by contact with the upper or rubber feed rolls which are geared to the worm shaft.

53. 0 + Only three of the steel feed rolls have gears. This is necessary to insure positive feeding during the sorting period.

54. − There are 13 chute blades of different length in every horizontal sorter.

55. − The spacing between the tips of the chute blades, that is, the distance from the tip of the "9" blade to the tip of the "8" blade, is 1/8".

56. − A new brush is timed in the sorter so that contact is made through "8" hole in the card when the card is 1/32" to 3/32" under the tip of the "9" blade.

57. + The sorter stops automatically after the last card has gone through the machine because the card lever contact opens the motor circuit stopping the machine.

58. + The commutator suppresses the sorting of any figure by opening the sorting circuit at the time the figure is passing under the selector brush.

59. 0 + The sorting armature is depressed when contact is made through the hole in the card by the knockoff cam.

60. + It is not necessary to hold the start key depressed after the machine has started because the cards going through the machine actuate the card lever relay, keeping the motor circuit closed.

2

If the first tabulation is to be (a), in what sequence should these reports be made in order to reduce sorting to a minimum?

50. ____ The digit capacity of the counters in the card counting sorter is five.

MECHANICS OF THE SORTER

51. ____ The card feed knives feed the cards from the bottom of the stack in the hopper to the first feed roll.

52. ____ The steel feed rolls are run by contact with the upper or rubber feed rolls which are geared to the worm shaft.

53. ____ Only three of the steel feed rolls have gears. This is necessary to insure positive feeding during the sorting period.

54. ____ There are 13 chute blades of different length in every horizontal sorter.

55. ____ The spacing between the tips of the chute blades, that is, the distance from the tip of the "9" blade to the tip of the "8" blade, is 1/8".

56. ____ A new brush is timed in the sorter so that contact is made through "8" hole in the card when the card is 1/32" to 3/32" under the tip of the "9" blade.

57. ____ The sorter stops automatically after the last card has gone through the machine because the card lever contact opens the motor circuit stopping the machine.

58. ____ The commutator suppresses the sorting of any figure by opening the sorting circuit at the time the figure is passing under the selector brush.

59. ____ The sorting armature is depressed when contact is made through the hole in the card by the knockoff cam.

60. ____ It is not necessary to hold the start key depressed after the machine has started because the cards going through the machine actuate the card lever relay, keeping the motor circuit closed.

INTERNATIONAL ELECTRIC BOOKKEEPING AND ACCOUNTING MACHINES

MECHANICAL PRINCIPLES

LESSON NO.

MANUAL OF INSTRUCTION

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 2—20—4

OPERATION

The tabulating cards, having been punched and sorted, are ready for tabulation and the connecting plugs must be placed in their proper sockets in the plugboard to permit the tabulation in any desired counter.

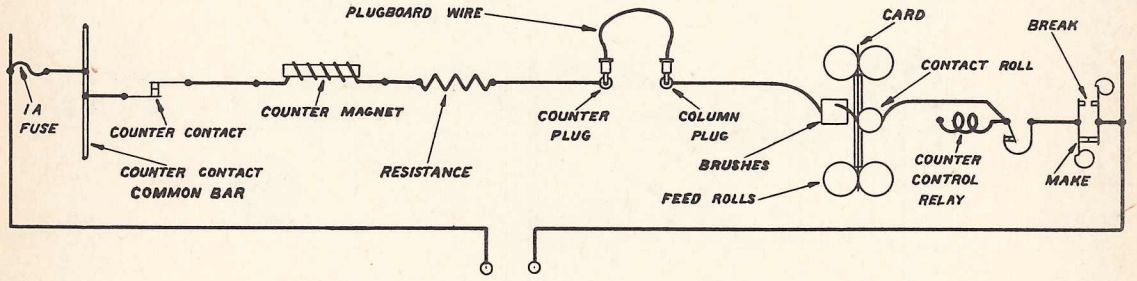
After having connected the counters to the plugboard, one of the punched cards to be tabulated should be run through and read against the dials to determine whether the machine has been set up correctly. This is to guard against the possibility of wrong results due to the machine being set up incorrectly.

PRINCIPLE OF TABULATING ELECTRICALLY

The cards are fed down vertically from the magazine, between the front and rear card guide plates by means of four sets of feed rolls, which are operated from a timed gear train.

The brush holder assembly contains 80 brushes, each insulated from the other and connected individually to a corresponding column plug hub in the plugboard.

The rear card guide plate consists of a contact roll assembly insulated from the brushes by the card. Obviously, a hole punched in the card will be the means of closing an electrical circuit which is briefly described and illustrated in the following paragraphs. This principle permits the utmost speed and flexibility. It is simple, accurate, and positive.

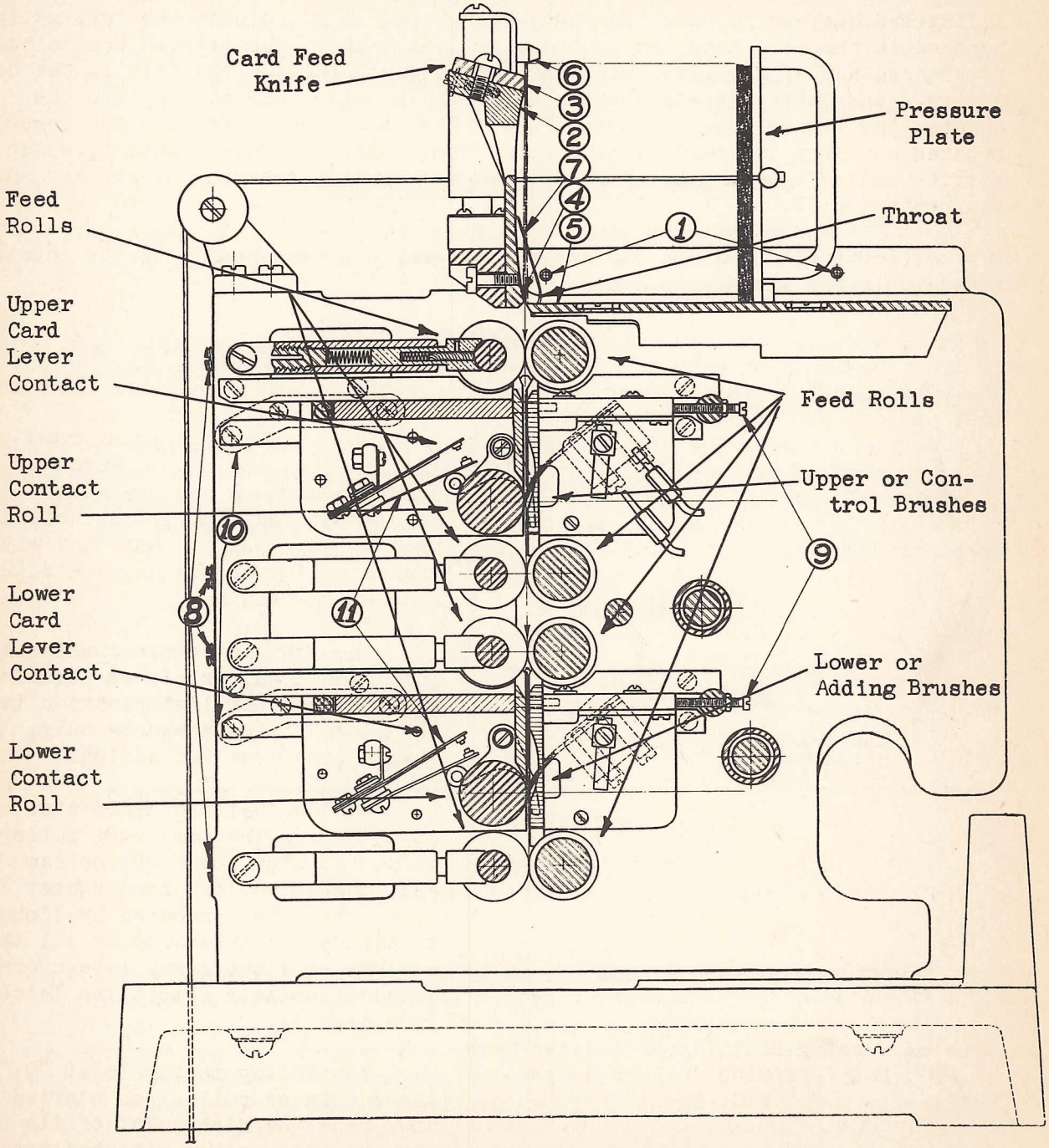


Schematic Diagram of Adding Circuit
FIG. 1

As the card passes through the machine the brush makes contact through the punched hole. This contact closes a circuit which energizes a magnet, the magnet in turn actuating an armature. The armature operates a clutch which causes a figure corresponding to the hole punched in the card to appear upon the adding wheel. A carry mechanism operates to "carry over" when the adding wheels pass "9" so that the next adjacent adding wheel adds "1" more. This, briefly, is how the electric accounting machine operates, i.e., by means of electrical contact through punched holes.

FEED UNIT

The standard feed unit, shown in Fig. 2. has four sets of feed rolls which accurately feed the cards between the brushes and the contact roll. The card feed knife adjusted to slice off just one card feeds the card through the throat also adjusted to pass just one card at a time.



Cross-Section of Feed Unit
FIG. 2

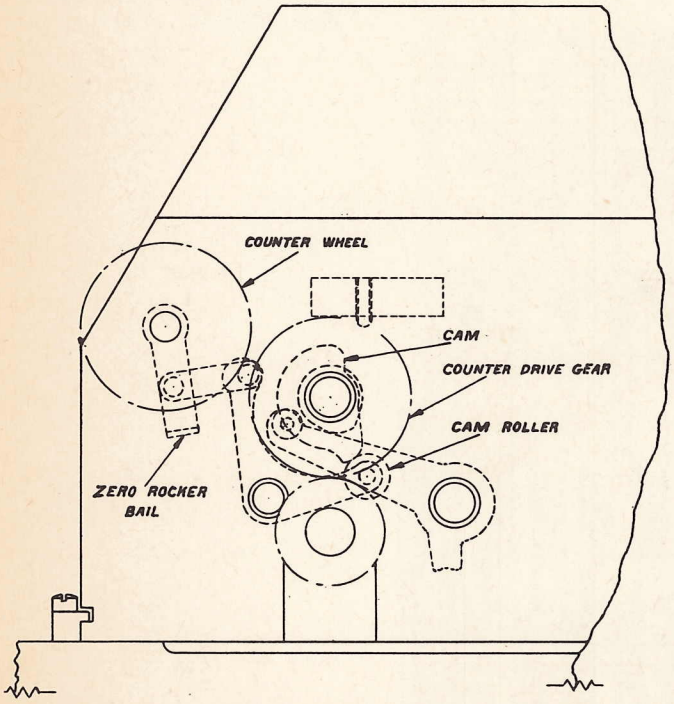
The first set of feed rolls taking the card from the knife feeds the card into the upper or control brushes. The 80 brushes read the card simultaneously. The card operating against the card lever closes the card lever contact which closes circuits to keep the machine feeding automatically as long as cards are in the machine.

The card, after passing the upper control brushes, is fed into the lower adding brushes, which simultaneously read from all 80 columns the information punched in the card into the counters or list banks. The circuit completed by the contact of the brush with the contact roll through the hole in the card causes a current to flow actuating the counter magnet and adding into the counter the figure punched in the card. The card passing through the lower brushes actuates the card lever closing the lower card lever contact, which permits adding into the counters only when a card is between the brushes and the contact roll.

After the information punched in the card has been read into the counters, the card is fed into the stacker.

COUNTERS

The object of the counter is to add or subtract and accumulate the various numbers punched in the card.



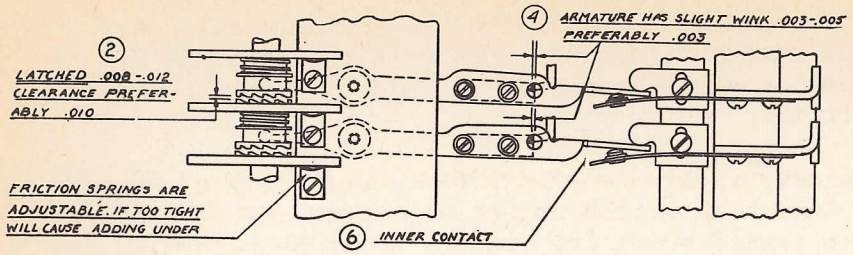
Drawing Showing Position of Counter Cams at "D" (Note Position of Zero Rocker Bail) FIG. 3

The standard 16-point counter has nine positions, eight adding positions and one extra accumulating position. This unit is used on all types of machines with the exception of the alphabetic accounting machine.

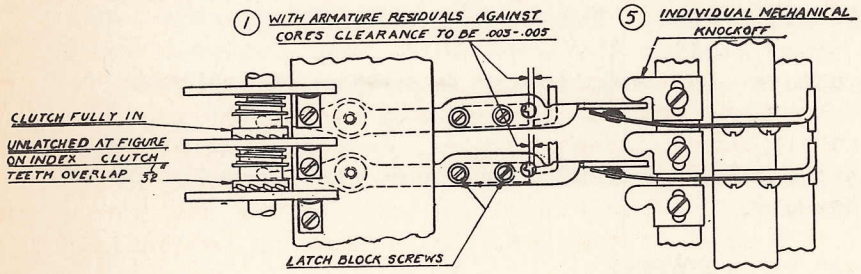
The 16-point cycle counter may have nine, ten, or eleven positions. In each case the last position is for accumulating purposes only, leaving the rest for adding.

Assume that the cycle starts at "D" where the cam lever roller is on the high point of the cam and, therefore, the zero rocker bail (which is connected by links to the cam lever shaft) is all the way back and the carry levers are latched on their respective latches (see Fig. 3).

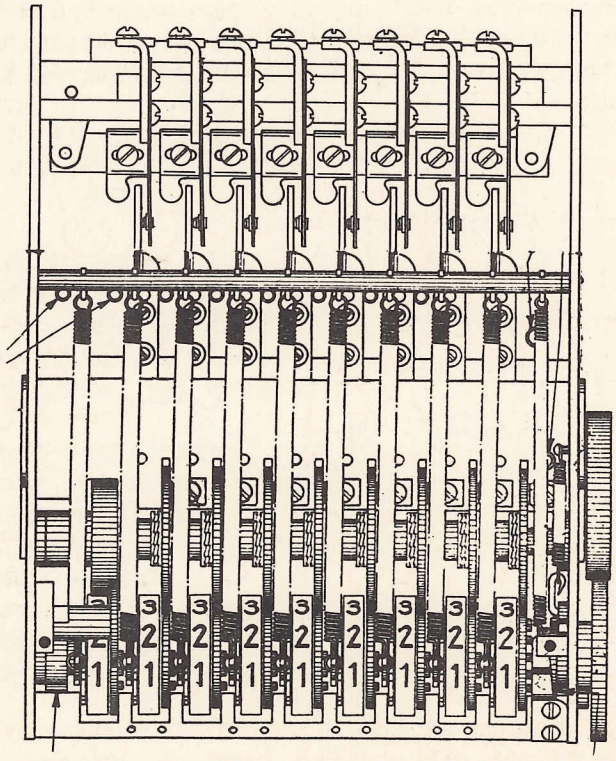
Continuing the cycle at "9," the cam lever roller has started down from the high point of its cam and the zero rocker attached has started forward.


② LATCHED .008-.012 CLEARANCE PREFERABLY .010
④ ARMATURE HAS SLIGHT WINK .003-.005 PREFERABLY .003
FRICTION SPRINGS ARE ADJUSTABLE. IF TOO TIGHT WILL CAUSE ADDING UNDER
⑥ INNER CONTACT

(a) Clutch Disengaged (Normal Position)


① WITH ARMATURE RESIDUALS AGAINST CORES CLEARANCE TO BE .003-.005
⑤ INDIVIDUAL MECHANICAL KNOCKOFF
CLUTCH FULLY IN
UNLATCHED AT FIGURE ON INDEX CLUTCH TEETH OVERLAP 1/2
LATCH BLOCK SCREWS

(b) Clutch Engaged (Counter Magnet Energized)



(c) Top View of Lower Counter as an Assembled Unit

Counter Mechanism
FIG. 4

Assume now that contact is made through the punched hole at "8" on the index. The counter magnet becomes energized, attracting its armature, which releases the clutch lever. When this clutch lever is released, it engages the clutch with the clutch gear teeth as shown in Fig. 4 (b).

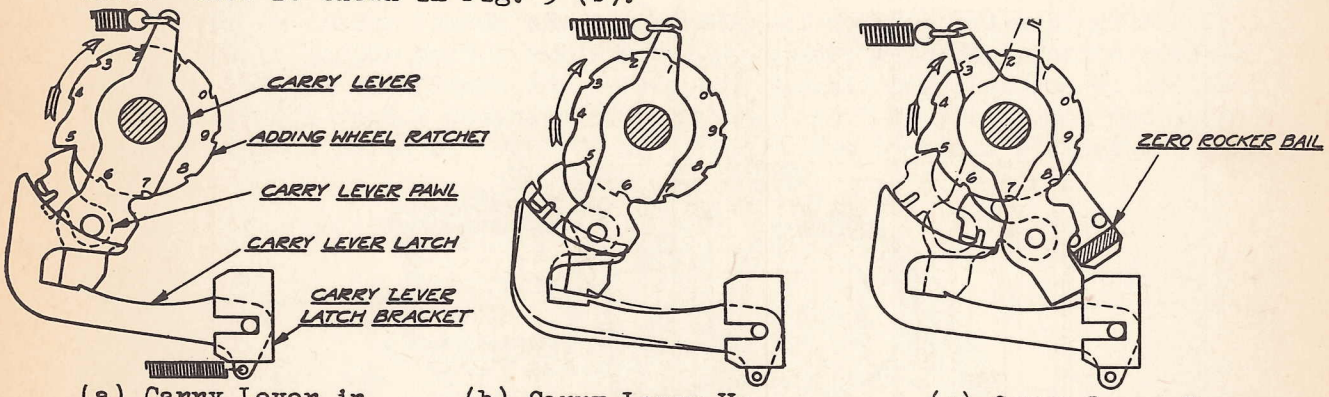
The clutch is keyed to the clutch shaft, which is revolving continuously while the machine is running. Therefore, when the clutch is engaged, motion is transmitted to the adding wheel through the clutch gear.

The clutch gear is connected to and timed with the adding wheel gear. Therefore, if contact is made through the punched hole in the card at "8," the clutch will be engaged as described above and the adding wheel turned until the figure "8" appears in the counter window.

When electromagnets are used, there is always the possibility of residual magnetism, which causes "sticking." The magnet armatures are, therefore, provided with a mechanical knock-off which insures the armature returning to its normal position. In addition to this, each armature is provided with a tension spring and lever which are designed to prevent unlatching of the clutch levers due to vibration.

Assume now that there are two cards following down through the feed rolls and each card is punched nine. At "9" on the card cycle, the magnet will be energized and the adding wheel turned to nine, as described above. The second card, also punched nine, will feed through on the second cycle and again the magnet will be energized and the clutch engaged. It is obvious that when adding two nines, the total of eighteen must appear on two adding wheels. This is accomplished as follows:

An ordinary adding wheel for adding tenths has ten teeth, including one high tooth, on its ratchet. This ratchet is so arranged that when a nine appears in the counter window, the high tooth will be in a position to cause its carry lever pawl to be pushed back, which in turn will cause the next adjacent carry lever latch to release its carry lever, which will then come forward. This is shown in Fig. 5 (b).



(a) Carry Lever in Latched Position - Zero in Counter

(b) Carry Lever Unlatched by High Point on Adding Wheel

(c) Carry Lever Returned by Zero Rocker Bail - Adding One

Cycle of the Carry Lever
FIG. 5

However, the pawl will not be on the high point of the adding wheel ratchet until the nine has almost disappeared from the counter window.

At the completion of the cycle, the zero rocker bail will relatch the carry lever and in so doing will cause the adding wheel next to the position which is adding nines, to turn forward one space or figure. The above operation is repeated each time any adding wheel reaches "9" in the counter window.

OPERATION OF CARRY LEVER

Fig. 5 (a) shows the carry lever in its normal latched position with the carry lever pawl resting normally behind the high tooth. When in this position, the zero appears on the adding wheel dial in the counter window. The direction of rotation of the adding wheel is indicated.

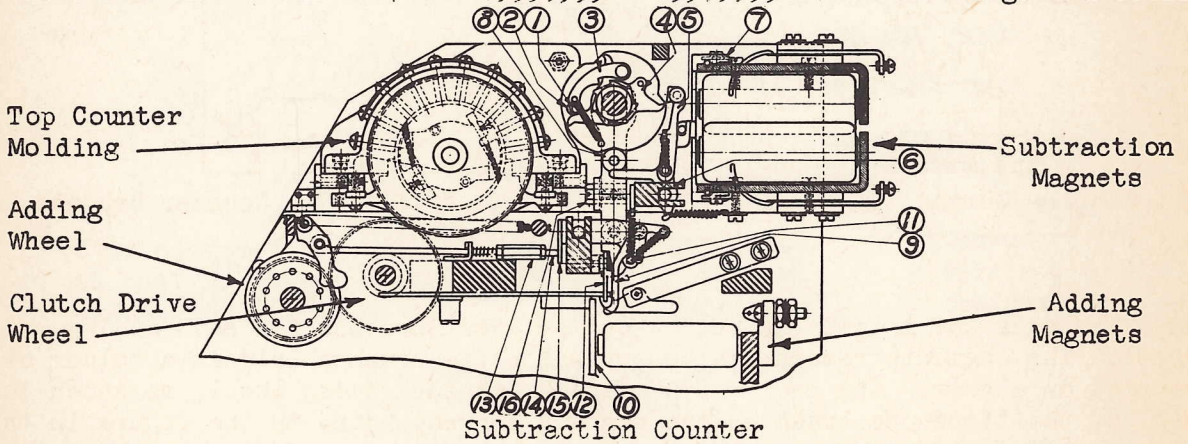
Fig. 5 (b) shows the high tooth of the adding wheel ratchet, operating the carry lever pawl which rides on the next adjacent carry lever latch to the left of the position which is adding. The ratchet wheel shown is a standard tenth wheel ratchet.

Fig. 5 (c) shows the next adjacent carry lever tripped and in its extreme forward position against the carry lever latch bracket. This places the carry lever pawl in position to engage in the next adding wheel ratchet tooth and the zero rocker bail traveling backward will then cause the carry lever to advance the adding wheel one position and also latch the carry levers back on their latches.

OPERATION OF SUBTRACTION COUNTER

This unit is equipped with two groups of magnets, there being one adding magnet and one subtracting magnet for each position of the counter except the ninth. The theory of operation of the counter may be described generally as follows:

Adding into the counter is effected in the normal manner as described, the subtraction mechanism remaining inoperative during adding cycles. Subtraction is accomplished through the use of the complement figure. For example, the complement of 7 is 99999993. To subtract 7 from 159 the difference between the number 7 and 99999999 or 99999992 is added to give a total



Subtraction Counter

FIG. 6

of 1000000151. An elusive one is added to the first position to make the number added a true complement, making the total in the counter 100000152. Since the "1" in the ninth position is beyond the capacity of the counter, the correct amount, 152, remains in the counter.

Subtraction is effected by energization of the adding magnet at "9" and by shifting the card brush circuits from the "adding" to the "subtracting" magnets so that impulses from the card brushes will pass directly to the subtraction magnets. See Fig. 6.

Energization of the subtraction magnet causes disengagement of the counter clutch and provides for stopping the adding wheel. For example, subtraction of 7 will actually cause the adding of 2. The counter clutch will be engaged at "9" in all positions of the counter and the adding wheel will have moved two-tenths of a revolution when contact is made at "7." At this time the counter wheel driving clutch will be disengaged, having added two, in the counter.

It might be explained that a special carry lever is used to add the "elusive one" into the units wheel of the counter during the subtraction cycle.

TOTAL PRINTING

Top Counter

At the end of the group or tabulation, the machine will automatically stop. It is necessary at this time to transfer the totals from the counter to the printed form of the report. The first step in this transfer is the top counter molding. Its position with respect to the adding wheel is shown in Fig. 6. The purpose of the top counter molding is to position a brush and complete an electrical circuit equivalent to the figure in the counter. A section of the top counter, showing the top counter brushes and segments, is shown in Fig. 7.

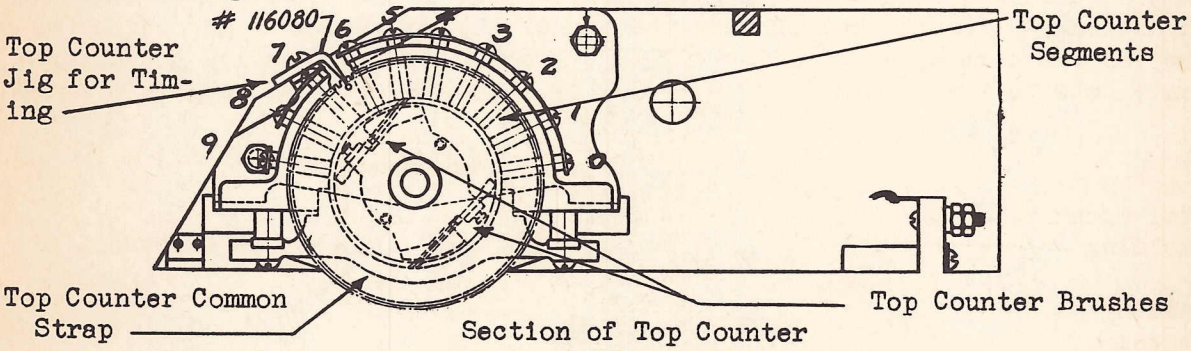


FIG. 7

There is one molding or set of segments and brushes for each adding wheel. The segments remain stationary while the brushes held in a holder are mounted on a gear. The gear which meshes with the adding wheel, as shown in Fig. 6, positions one brush on the segment corresponding to the figure in the counter. The other brush riding on the common strap completes a circuit from the segment through the common strap to the emitter. For example, the brushes in Fig. 7 are in position to print a "5."

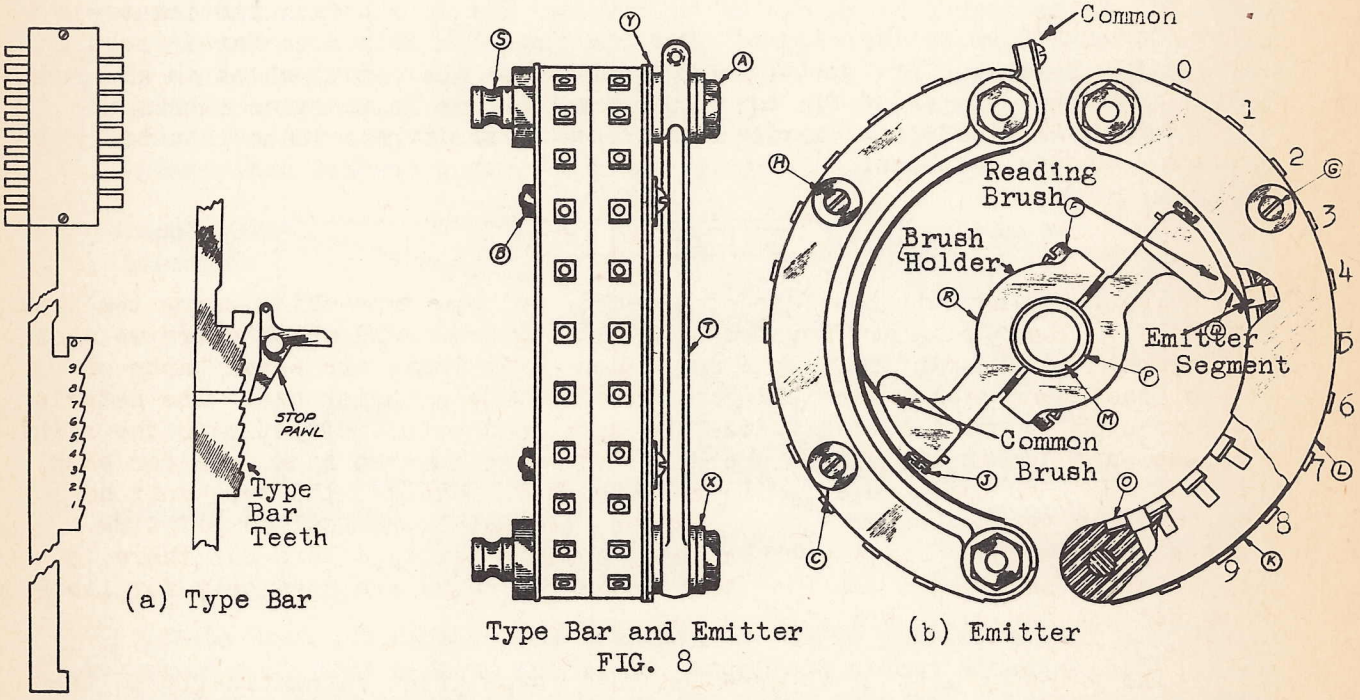
Emitter

The purpose of the emitter shown in Fig. 8 (b) is to time the electrical impulse through the top counter segment so as to cause the printing of a "5"

when there is a "5" in the corresponding adding wheel. The emitter consists of ten segments, from "9" to "0," which remain stationary, and two brushes held in a holder. The brush holder is fixed to the reset shaft which turns as the type bar raises into printing position. Only one set of emitter brushes and segments is necessary for total printing, but two or more emitters are generally used to divide the current load. As the emitter brushes turn, the total printing circuit will be completed for the above case when the reading brush makes at "5." At this time the type bar will be in such a position that if the "stop pawl" is tripped (see Fig. 8a) the type bar will be stopped by the stop pawl to print a "5" for the "5" in the adding wheel.

Print Magnet Unit

The printing magnet unit is an arrangement of magnets whose armatures control small latches which in turn release pawls known as "type bar stop pawls. There is one stop pawl for each type bar. In a seven bank machine, therefore, there will be a total of sixty-five printing type bars and five asterisk bars, together with the necessary stop pawls, latches, pull rods, armatures, and magnets. It will be readily observed that when the printing magnet is energized, the armature is attracted causing the latch to release its stop pawl and engage the type bar teeth.



(a) Type Bar

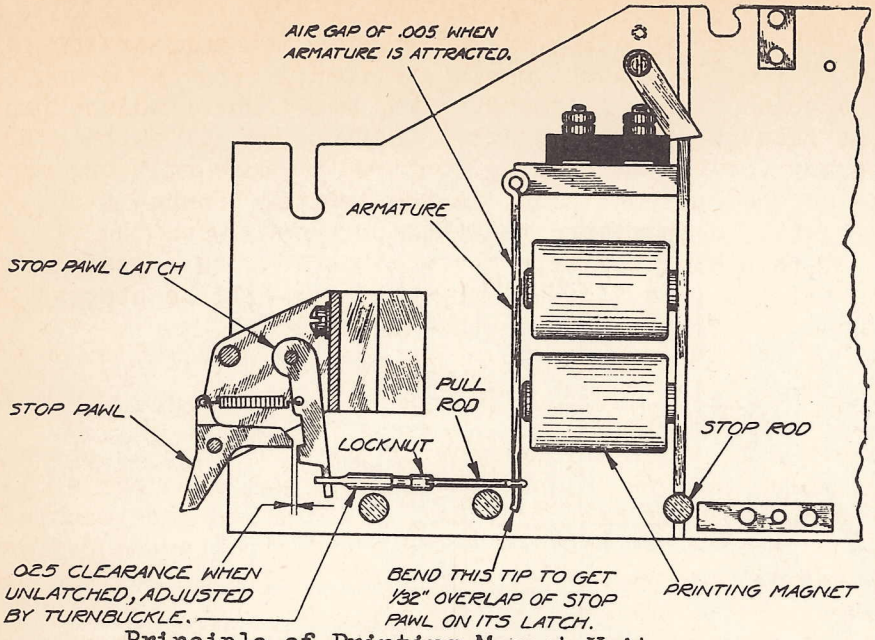
Type Bar and Emitter (b) Emitter

FIG. 8

These printing magnets are energized directly from the adding brushes when listing and through the top counter and emitter when total printing.

Fig. 9 illustrates the mechanical principles of the printing magnet unit mechanism.

As the printing magnet is energized the armature is attracted to the magnet cores. This motion is transmitted through the pull rod to the stop


AIR GAP OF .005 WHEN ARMATURE IS ATTRACTED.
ARMATURE
STOP PAWL LATCH
PULL ROD
STOP PAWL
LOCKNUT
STOP ROD
.025 CLEARANCE WHEN UNLATCHED, ADJUSTED BY TURNBUCKLE.
BEND THIS TIP TO GET 1/32" OVERLAP OF STOP PAWL ON ITS LATCH.
PRINTING MAGNET

Principle of Printing Magnet Unit
FIG. 9

pawl latch. The stop pawl now unlatched is drawn forward by its spring and engages the type bar as shown in Fig. 8 (a), positioning the type bar for printing.

It is necessary in actual practice to provide a means for positively relatching the stop pawls after the printing has been completed. A cross-section of the printing magnet unit with the relatching mechanisms is shown in Fig. 10.

At the end of the total printing cycle the cams shown on the reset shaft operate the relatch bar to raise the stop pawl into position for relatching. At the same time another cam on the reset shaft operates the knockoff bar to overcome any residual magnetism in the print magnets and to positively advance the stop pawls latches into their normal latched position.

THE PRINTING UNIT

The printing unit consists of a number of type bars which carry the type (0 to 9). These bars are mounted in a sliding crosshead which operates when listing or total printing. In a seven-bank unit there are seven banks of type, each bank having nine printing bars and one asterisk bar. The asterisk bar is used to print a star beside the total and prints directly to the right of the units position. There are nine type bars in each bank, one for each adding wheel in the counter. In the seven-bank machine, the type unit has, in addition to one bank for each counter, two more banks called "listing banks." These two "listing banks" each contain ten type bars but there is no asterisk bar due to the fact that these two banks are used only for listing and not for total printing.

The printing unit is so arranged that zeros print automatically to the right of any figure but not to the left of a figure. This is accomplished by an assembly known as the "zero pawl assembly." When a significant figure appears in any other than the units position the zero pawl assembly will automatically stop all type bars to the right of the significant figure at zero and cause the printing of zeros in every type bar to the right of the figure.

A diagram showing the principle of printing the amounts set up in type bars is seen in Fig. 11.

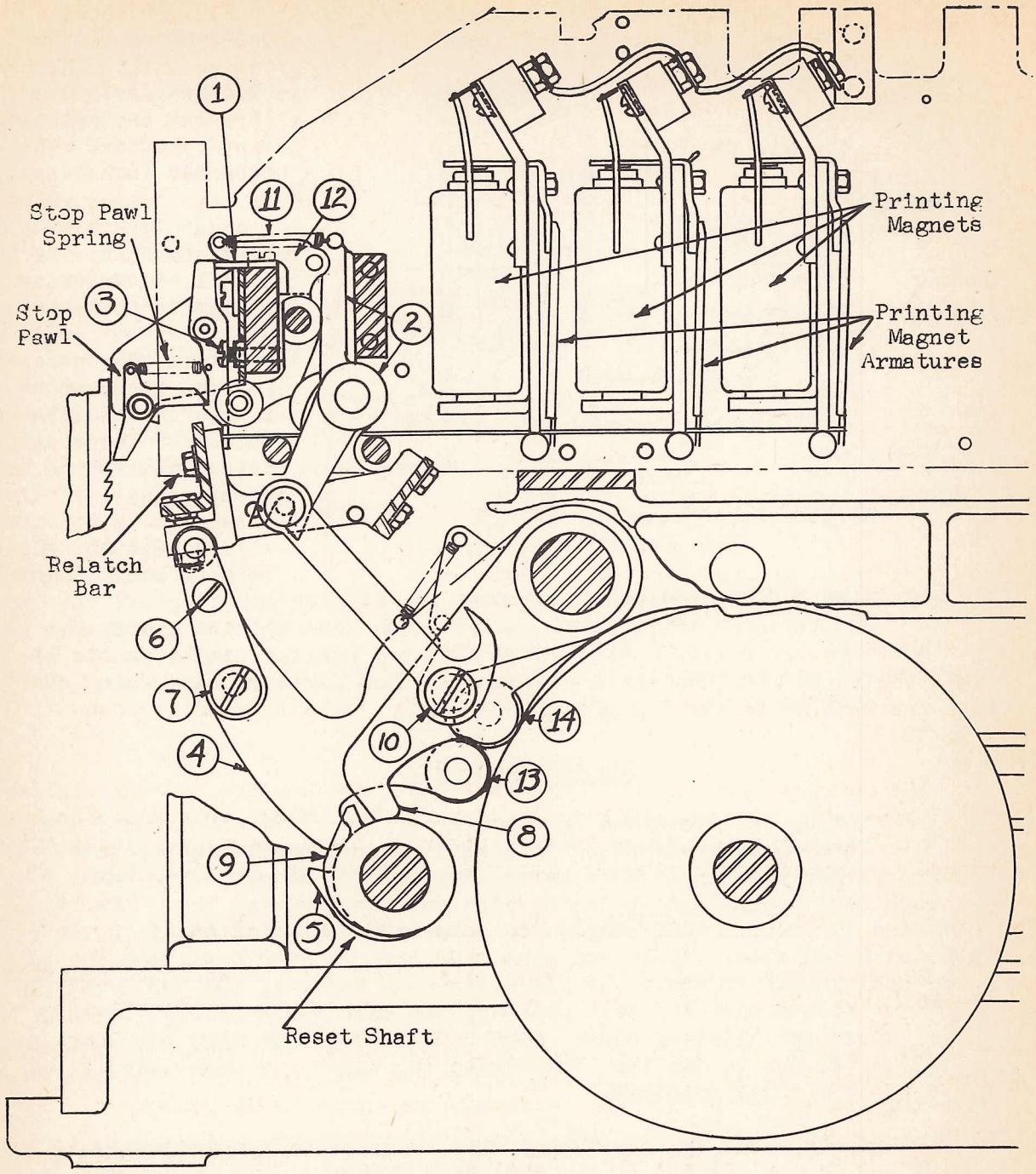
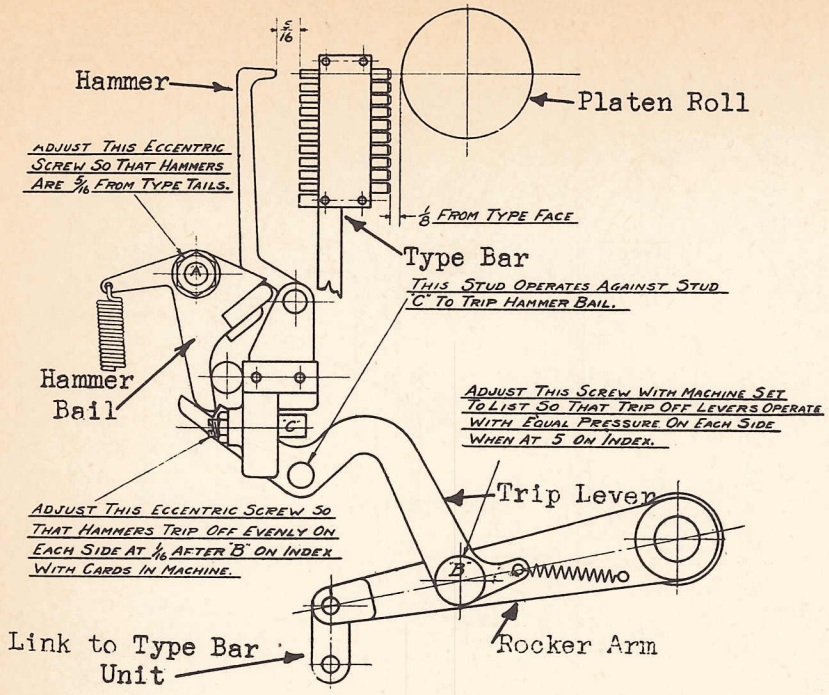


FIG. 10

As the rocker arms raise the type bars into printing position, the trip levers operate against the hammer bail. As the hammer bail is drawn back against the pressure of the hammer bail springs, the hammers also fall back into striking position. The stud "C" trips the hammer bail which carries the hammers to up to 5/16" from the type tails. The momentum acquired by the hammers carries the hammers into the type printing the totals set up by the bars.


Hammer
Platen Roll
ADJUST THIS ECCENTRIC SCREW SO THAT HAMMERS ARE 5/16 FROM TYPE TAILS.
1/8 FROM TYPE FACE
Type Bar
THIS STUD OPERATES AGAINST STUD C TO TRIP HAMMER BAIL.
Hammer Bail
ADJUST THIS SCREW WITH MACHINE SET TO LIST SO THAT TRIP OFF LEVERS OPERATE WITH EQUAL PRESSURE ON EACH SIDE WHEN AT 5 ON INDEX.
Trip Lever
ADJUST THIS ECCENTRIC SCREW SO THAT HAMMERS TRIP OFF EVENLY ON EACH SIDE AT 1/16 AFTER "B" ON INDEX WITH CARDS IN MACHINE.
Link to Type Bar Unit
Rocker Arm

Schematic Diagram Showing Operation of Print Unit
FIG. 11

Fig. 12 shows a cross-section of the printing unit. The hammer lock shown as "5" serves to prevent the printing of any type bar. When the hammer lock is pulled down, the hammer is pushed forward to where it will not be struck by the hammer bail, suppressing the printing in that bar.

It is also necessary to return the hammers after the figures have been printed. To accomplish this positively the hammer return bail returns the hammers to the normal position as soon as the type bars start downward.

The print unit is operated from the list cam which turns when the machine is set to "list" and from the reset shaft when the machine is total printing. The reset and list cams are shown in Fig. 12.

The carriage used on all Electric Accounting Machines is very similar to a typewriter carriage and has standard spacing of six spaces to the inch when single spacing and three to the inch when double spacing. It is arranged to accommodate a sheet of paper 20 inches wide.

GROUP INDICATING, TABULATING, AND TOTAL PRINTING

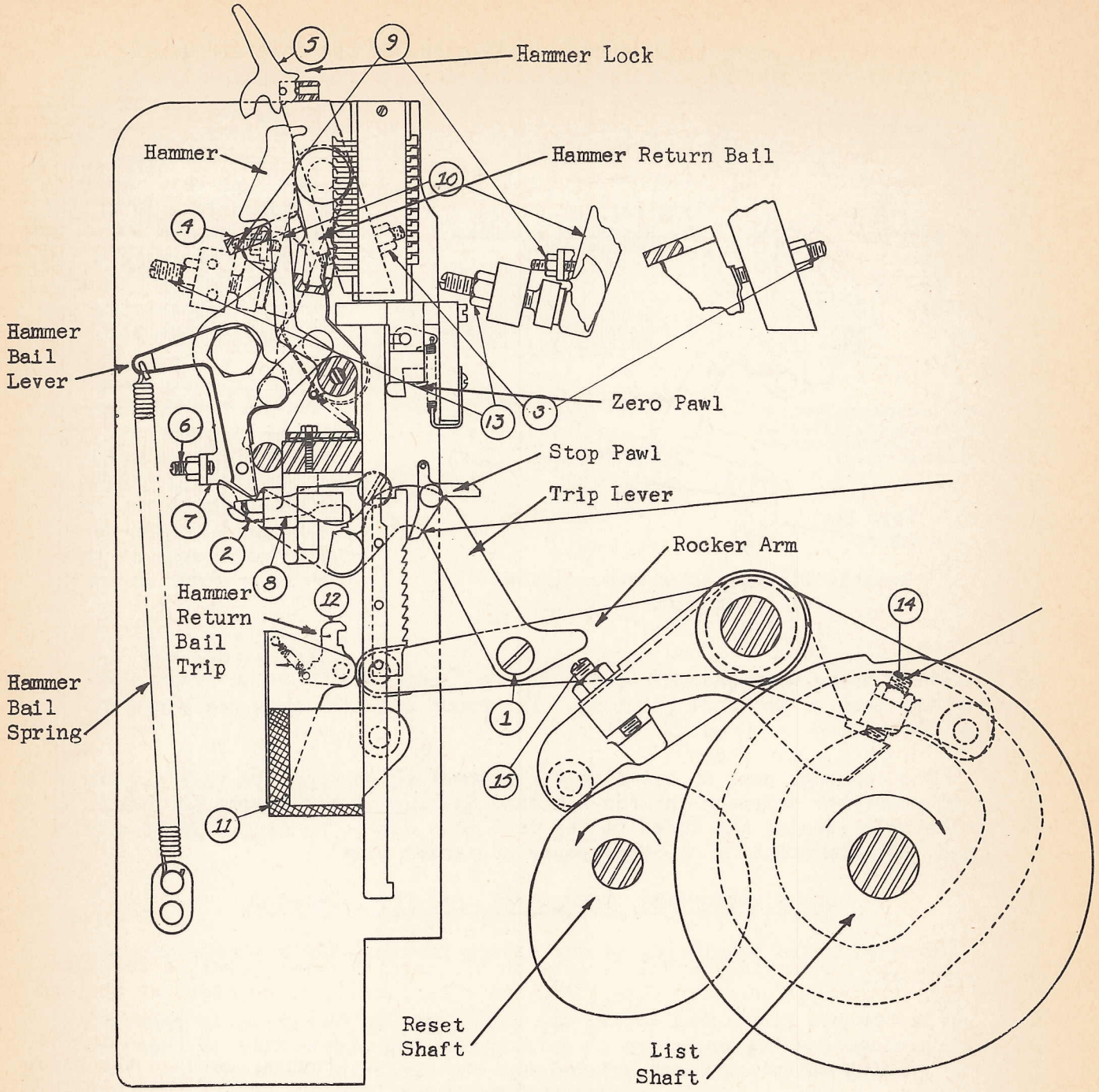
Generally the tabulating of any report involves two separate printing operations.

1. On the first card cycle, the indication of the group is printed and the carriage spacing mechanism is latched and the platen roll is then held from turning while the machine tabulates the cards in the group.

2. The total is printed on the reset cycle at the end of the group. At the end of the group the total must be printed on the same line where the indication was already printed.

LISTING - TOTAL PRINTING

When it is desired to list each card, the shifter handle is set to "List."

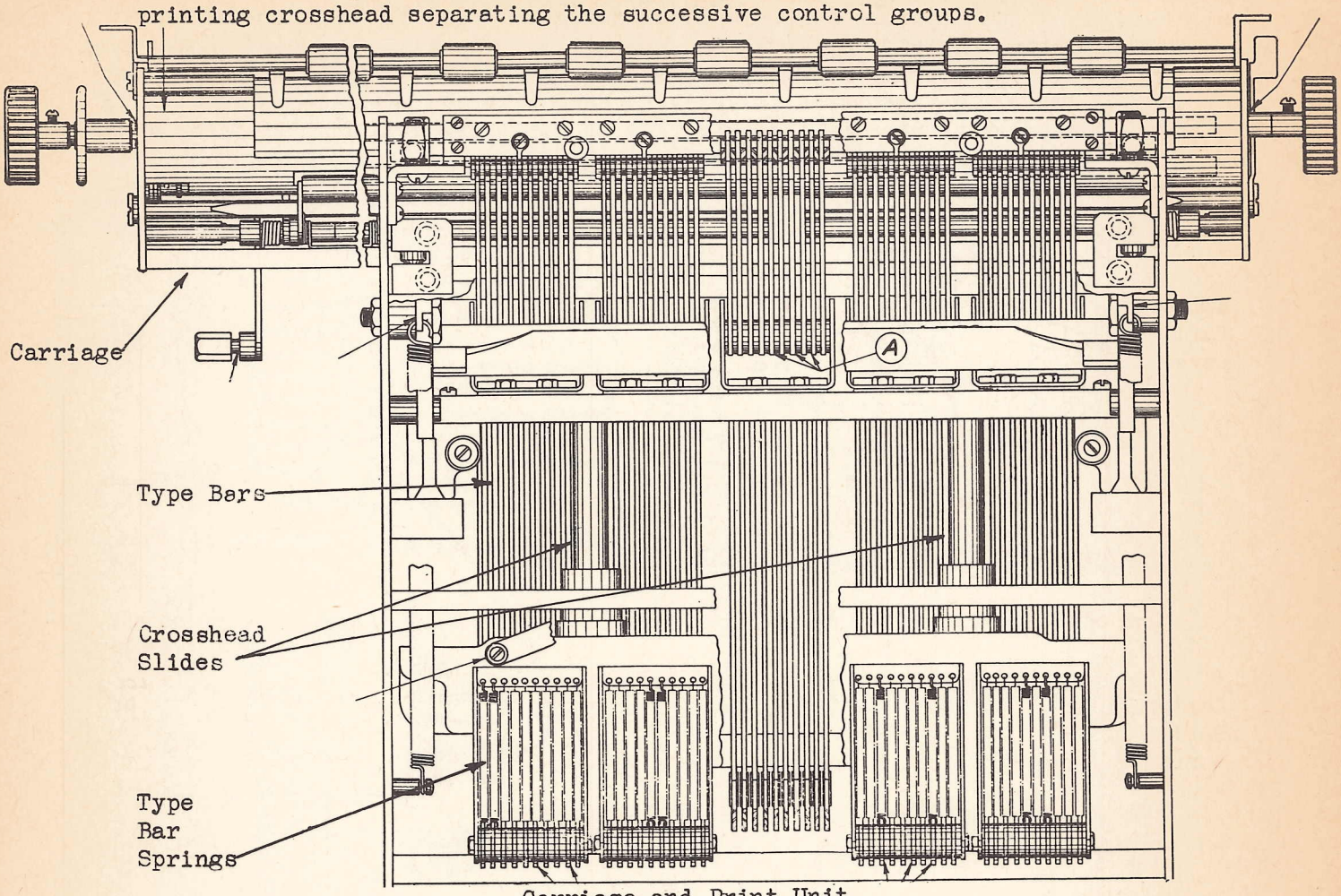


Cross-Section of Print Unit
FIG. 12

Each time the printing crosshead moves up, the platen is advanced one space. This action takes place on each card cycle, thus feeding the carriage platen roll one or two spaces each time according to the position of the space control lever.

When the listing is completed and the total is to be printed, the platen roll is moved one space on the up-stroke of the printing crosshead before

the hammers trip off and one additional space on the down stroke of the printing crosshead separating the successive control groups.



Carriage and Print Unit
FIG. 13

AUTOMATIC CONTROL

The automatic control feature on the machine makes possible the automatic printing of group totals and the clearing of the counters at the end of a group.

The machine, through the use of two sets of brushes, matches the holes in the control field with those in the succeeding card and if they are in agreement, that is, if they belong to the same group, the machine will continue to feed automatically. When the holes in the card passing through the upper or control brushes fail to agree with those in the card passing through the lower or adding brushes, the machine will stop and automatically print the totals for the group, clear the counters, and proceed with the next group.

The principle of automatic control is best illustrated by an example. For the sake of simplicity, only the minor control will be discussed, in which case the switches marked "INT" and "MAJ" will be closed, shunting out intermediate and major control. See Fig. 14.

If the machine is to be set to control on three columns in the card, both the adding and control brushes corresponding to this field in the card are wired to the control unit as shown in Fig. 14. The cards are then placed in the machine and the start key depressed. The machine will continue for two cycles until the first card is ready to read into the adding brushes. It is then necessary to depress the reset key to clear the counters and pick up the minor control relay. The machine is now ready to add and automatically control on the three column field.

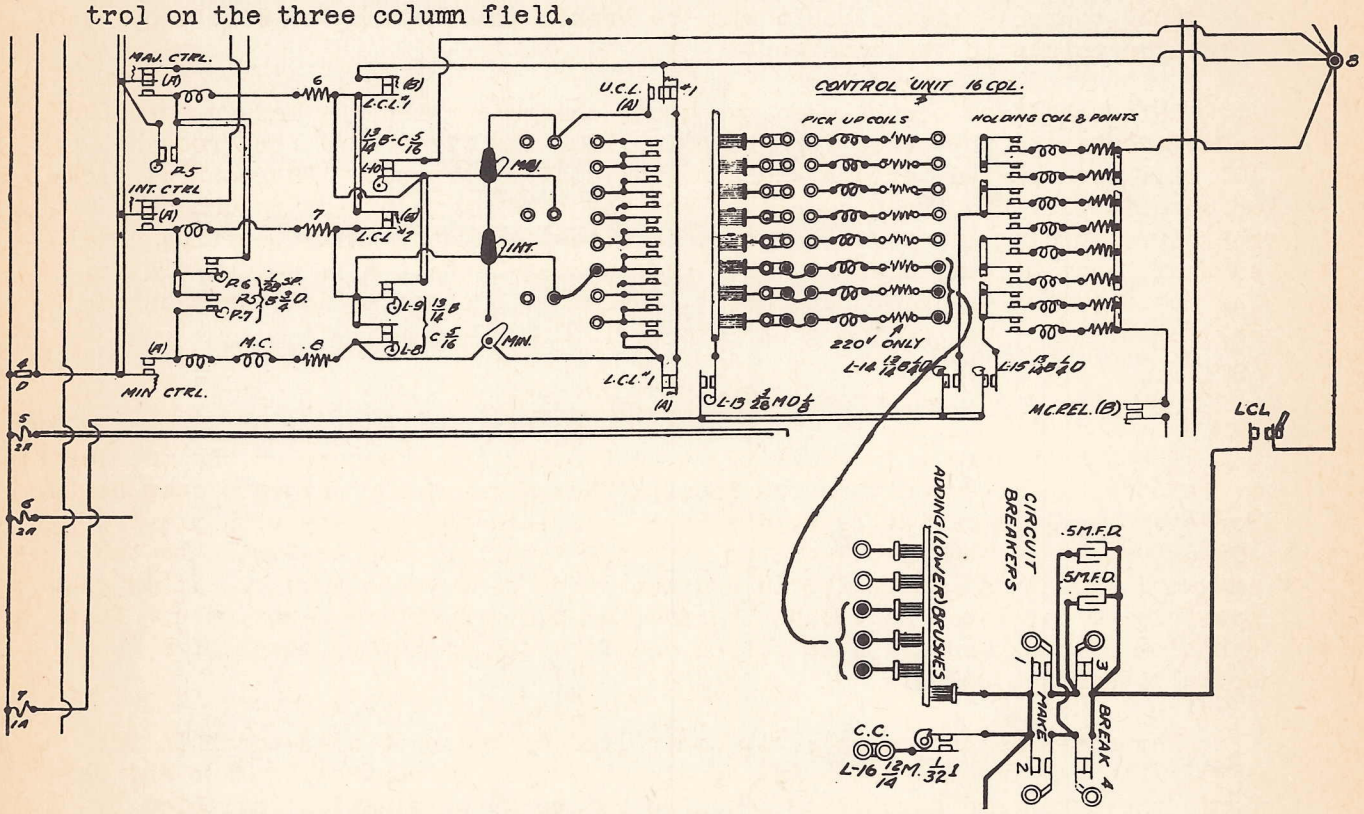


Diagram of Automatic Control and Group Indication Circuits
FIG. 14

On the next cycle the first and second card are simultaneously going through the adding and control brushes, respectively. If the holes in the units column of the "control" field on both cards are the same, a circuit will be completed from fuse 7, L-13 cam contact, control contact roll, hole in card #2, control brushes, plugwire to control plug hubs, control pickup coils, control hub, plugwire to adding brush, plug hubs, add brushes, hole in card #1, lower contact roll, circuit breaker contacts, lower card lever contact, to the other side of the line. The holes in the tens and hundreds columns are matched by similar circuits.

The control relays have two coils, the pickup and the holding coils. The pickup coil is energized by the circuit described above, and the points of the relay make, closing the circuit through the holding relay coil. This energizes the holding coil and keeps the relay picked up after the hole has passed the brushes, opening the pickup circuit.

The control relay has two sets of points as well as two coils, and the

second set of points known as the inner series contacts are in the motor control relay circuit. This circuit is carried by a cam and contact, L-8, for nearly all of the card cycle. During the short period when this cam and contact is not carrying the motor control relay circuit, the inner series contacts are called upon to carry it. There is one contact for every position in the field being controlled and if the holes have not matched in every column in the field, one of the contacts or relay points will be open and the motor control relay circuit will be broken and the machine will stop, and print the totals in the counter.

This condition occurs when the group changes. When the machine has finished tabulating the cards for group No. 100, the first card for group No. 101 will have passed through the upper or control brushes. The control pick-up circuit will have been completed for the tens and hundreds column, and the corresponding inner series contacts closed, but the units position circuit will not be completed and the inner series contact will not be closed. The motor control relay circuit will, therefore, be broken and the machine will stop, and reset as the group changes.

CLASS SELECTION

Through the use of a very simple, but important, feature on the tabulator, it is possible to sub-divide or classify the cards in a group into components. For example, in a payroll analysis it is possible to separate within a group the day-work and the piece-work so that the total in counter 4 will be the day-work amount and the total in counter 5 the piece-work amount. It is also possible to separate the productive and the non-productive labor, etc. This function is known as class selection and is accomplished by means of a gang or multi-contact relay.

The class selection relay is controlled by means of an X-punch in the card. The "X" impulse reads in through the upper or control brushes and performs the necessary counter or field selection or elimination indicated by the presence or absence of the X-punch before the card reaches the lower or adding brushes.

Fig. 15 (a) shows the class selection relay as used for counter selection. When there is no X punched in the control column the adding brush will read into one of the common or center straps of the multi-contact relay through the normally closed points (since the coil has not been energized) to counter 1. With an X in the card in the control column the adding brush will read the same column in the card but the amount will be transferred through the now picked up points of the multi-contact relay to counter 2.

Fig. 15 (b) brings out the use of the class selector as a field selecting device. In this case the former procedure is reversed. The common or center strap of the class selector relay is connected to the counter. When there is no X punched in the control column the adding brushes in field 1 are connected through the normally closed points to counter 1. The coil of the class selector relay is not energized. With an X in the control column the coil is energized and the adding brushes in field 2 read through the picked up points of the gang relay into counter 1. The connection to field 1 is broken by the action of the relay.

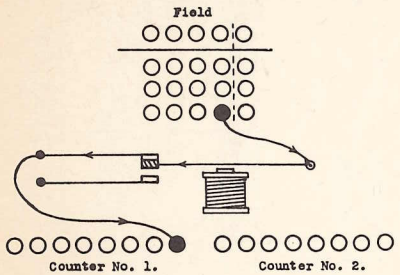
By leaving one side of the points disconnected it is possible to use the class selector as an eliminator for selecting cards of only a certain class to add in a counter. Referring to Fig. 15 (c), all information not X-punched will read from the adding brushes through the normally made points into the counter and all X-punched cards will be eliminated when the multi-contact relay coil is energized opening the circuit between the adding brushes and the counter.

The three uses of the class selector described above may be combined in numerous ways to produce classified reports of any degree of complexity. Fig. 16 illustrates some of the more common applications of class selection.

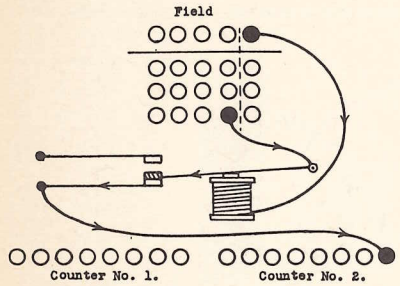
COUNTER SELECTION

INFORMATION PUNCHED IN ONE FIELD IN THE CARD IS DISTRIBUTED TO TWO OR MORE COUNTERS OF THE MACHINE.....

A. Card without X punch in control position registers in Counter No. 1.



B. Card with X punch in control position registers in Counter No. 2.

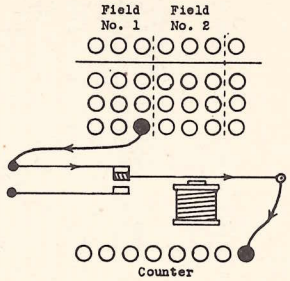


(a) Counter Selection

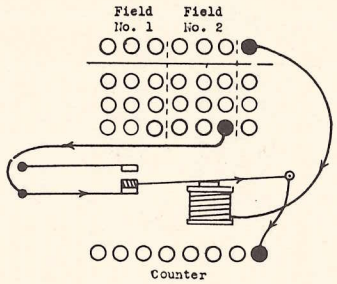
FIELD SELECTION

INFORMATION PUNCHED IN TWO OR MORE FIELDS OF THE CARD IS TABULATED FROM ANY ONE IN A SINGLE COUNTER.....

A. Card without X punch in control position .. Field No. 1 registers in counter.



B. Card with X punch in control position .. Field No. 2 registers in counter.

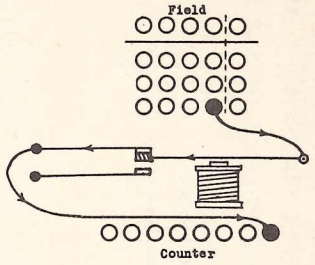


(b) Field Selection

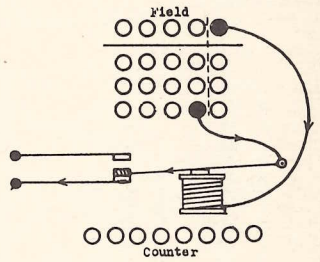
CLASS ELIMINATION

CERTAIN CLASSES OF INFORMATION PUNCHED IN A SINGLE FIELD OF THE CARD ARE AUTOMATICALLY ELIMINATED FROM TABULATION.....

A. Card without X punch in control position registers in Counter.



B. Card with X punch in control position DOES NOT register in counter.



(c) Class Elimination

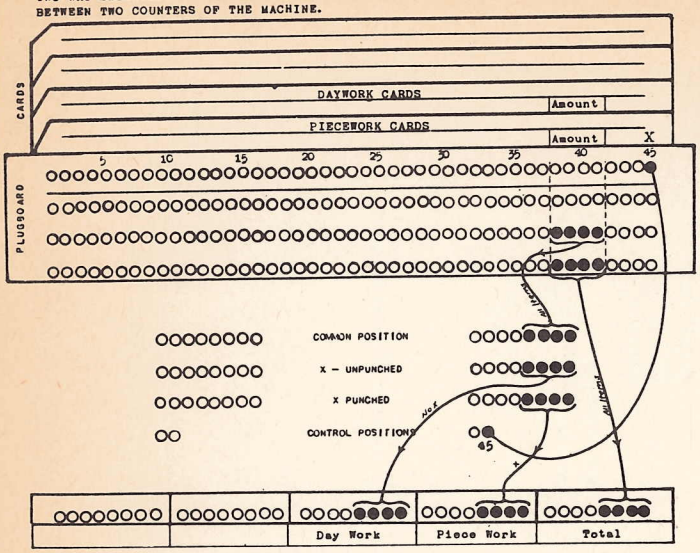
Examples Illustrating the Use of Class Selection

FIG. 15

COUNTER SELECTION — EXAMPLE NO. A-1

CLASS SELECTION

TWO WAY SELECTION -- INFORMATION PUNCHED IN ONE FIELD OF THE CARD DISTRIBUTED BETWEEN TWO COUNTERS OF THE MACHINE.



OTHE REPORTS -- SAME WIRING

PAYROLL ANALYSIS		
Productive	Non-Productive	Total

MATERIAL ANALYSIS		
Material	Labor	Prime Cost

STOCK REPORT		
On Order	On Hand	Total Available

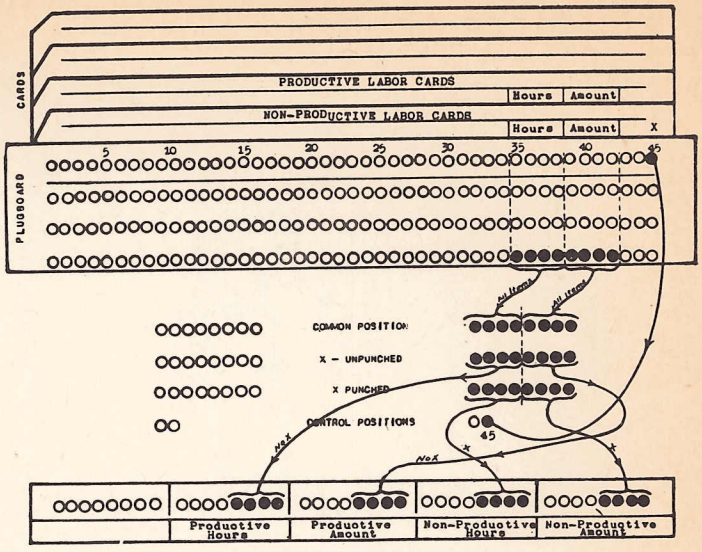
SALES BY CLASS OF CUSTOMER		
Jobbers	Retailers	Total Sales

SALES BY CLASS OF SALE		
Direct Sales	Mail Sales	Total Sales

COUNTER SELECTION — EXAMPLE NO. A-2

CLASS SELECTION

DOUBLE TWO WAY SELECTION WITH ONE SPLIT SELECTOR

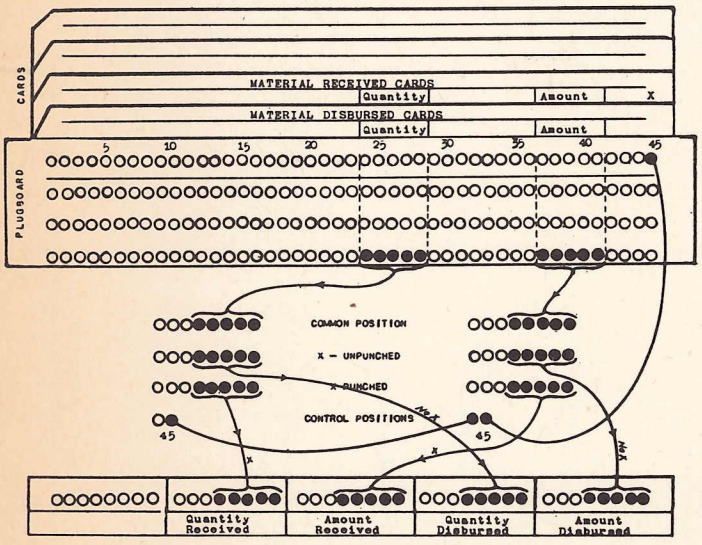


OTHER REPORTS -- SAME WIRING

COUNTER SELECTION — EXAMPLE NO. A-3

CLASS SELECTION

DOUBLE TWO WAY SELECTION WITH TWO SELECTORS



OTHER REPORTS -- SAME WIRING

INTRANSIT ACCOUNT CHECK LIST				
	Forwarded		Received	
	Advances	Prepaid	Advances	Prepaid

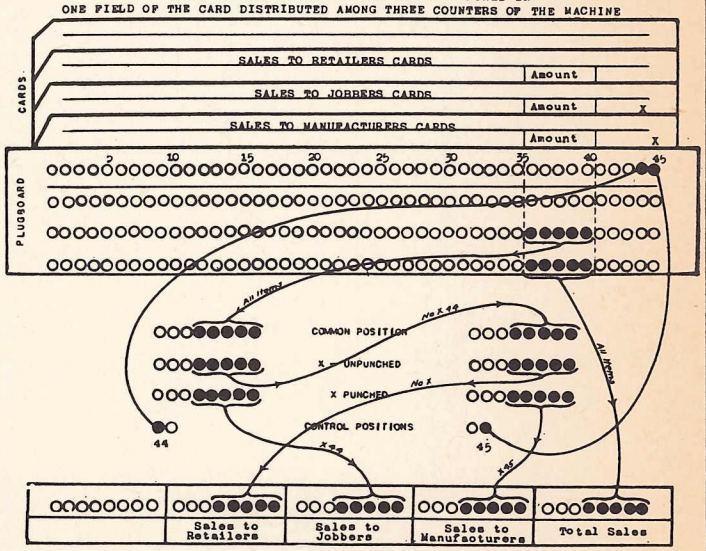
SALES BY CLASS OF SALES				
	Mail Sales		Salesman's Sales	
	Quantity	Amount	Quantity	Amount

PAYROLL ANALYSIS			
	Productive Labor		Non-Productive Labor
	Hours	Amount	Hours	Amount

COUNTER SELECTION — EXAMPLE NO. A-4

CLASS SELECTION

THREE WAY SELECTION -- INFORMATION PUNCHED IN ONE FIELD OF THE CARD DISTRIBUTED AMONG THREE COUNTERS OF THE MACHINE



OTHER REPORTS -- SAME WIRING

REPORT OF PREMIUMS AND LOSSES				
	Gross Premiums	Cancellations	Losses	

COST REPORT				
	Labor	Material	Burden	Total Cost

SALES BY CLASS OF SALE				
	Cash	Charge	C.O.D.	Total Sales

FIG. 16

BUSINESS
INTERNATIONAL
MACHINES

TABULATORS AND ACCOUNTING MACHINES

TYPES OF MACHINES

LESSON NO.

Frank J. Lucas.
75016

MANUAL OF INSTRUCTION

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 2—20—3

Vertical tabulation

90 C.P.M.
45 column size only
Group indication is fixed in 1st counter by switch
110 or 220 AC or DC 12.8 amps start on 110 DC 0.7 mm
23 amps start on 40 5 mm

1st start
2nd Stop
3rd reset

Automatic control tabulator
2 set brushes adding & controlling no stop cards.
45 or 80 column 5 counters
Index wheel timing & indicating
Reset motor.

Type 285
automatic plug boards
Printer
75 list 75 tabulate
75 " 150 "
120 " 120 "
120 " 150 "

Subtraction
Net minus
Sub. neg.
Elusive Neg.

TABULATORS AND ACCOUNTING MACHINES

International Tabulating and Accounting Machines are automatic multiple adding and listing mechanisms which are actuated and controlled by perforated cards. They are used to compile statistical and accounting reports to assist management in the control of all types of business.

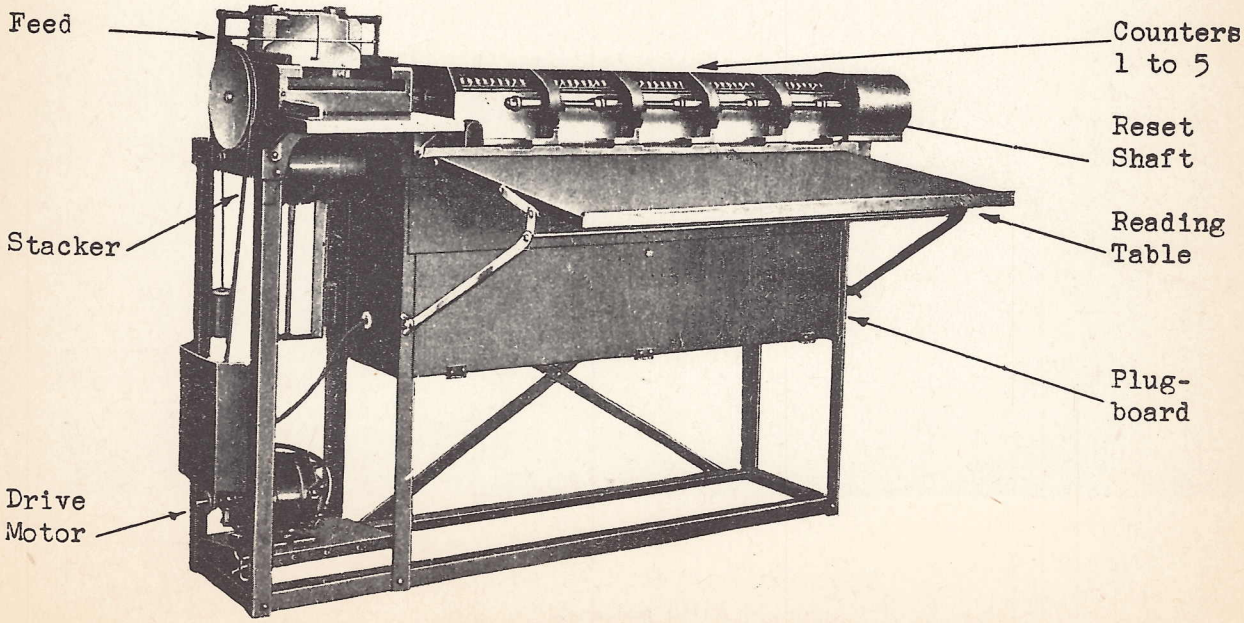
Good business judgment is required by every industrial executive and is based upon the analyses of accurate and timely figure-facts. These accounting and statistical bases of managerial decisions are compiled most effectively by means of tabulating machines. The wide variety of problems and sizes of business necessitates the manufacture of numerous types and styles of tabulating machines. IBM has met this condition by developing and manufacturing machines that can readily be adapted to any accounting need. These are described briefly in the following pages.

Long strides have been taken in the Engineering Department with newer and more efficient machines. From the days of the old piano-box type tabulator, machines have undergone constant improvement until today they are considered the most advanced form of accounting equipment.

The study of the history of IBM traced the major steps in the development of machines, such as plugboards, automatic control, printing mechanisms, etc., but a study of the following pages will reveal the types of tabulators and accounting machines which are in current commercial use today.

ELECTRIC TABULATING MACHINE - TYPE 92

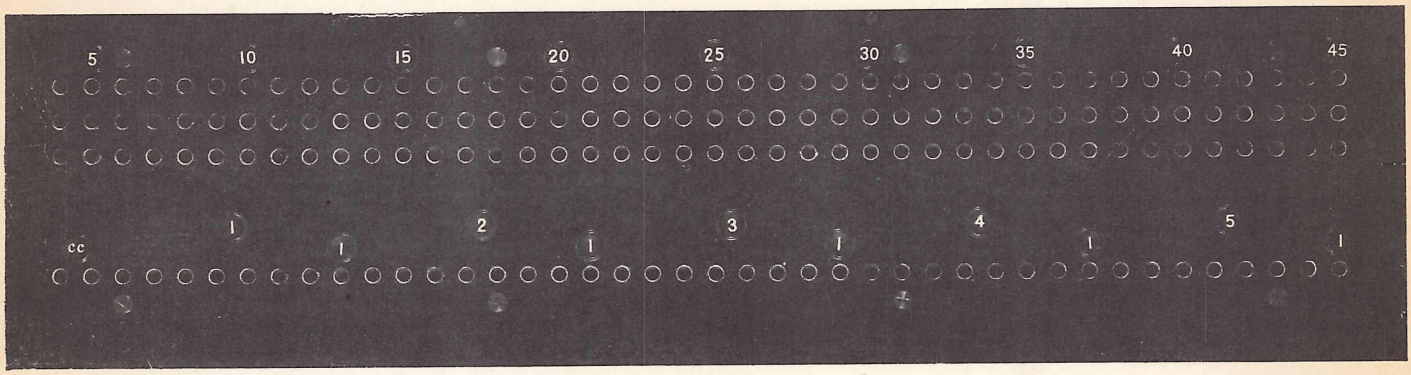
The Electric Tabulating Machine is used to indicate and total the items in various fields on the card, the counters operating simultaneously at a speed of 150 cards per minute. Each counter has an adding or indicating capacity of eight digits, and an accumulating capacity of nine digits.



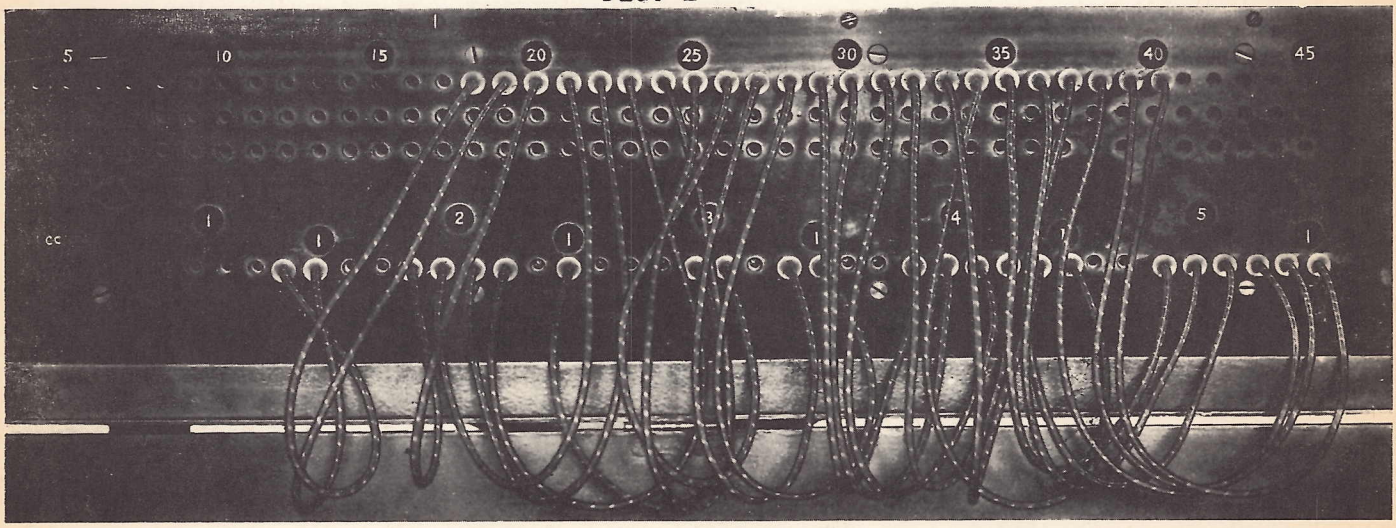
Electric Tabulating Machine - Type 92
FIG. 1

On the plugboard (Fig. 2) of the machine are three rows of numbered hubs corresponding to the columns on the card. Below these are several groups (as many as counters) of hubs, numbered to correspond with the eight adding positions in each counter. Hub No. 1 is connected to the unit wheel in the counter No. 1, and so on. When plugging in a field to be added, first determine the numbers of the columns in the field, then connect with the plug wires the hubs representing these columns to the hubs connecting to the counter in which the field is to be added. By utilizing the second and third rows of hubs representing the columns on the card, the same field can be added in two or three different counters at the same time, thereby permitting the tabulations on one counter to be accumulated to sub and grand totals on the other two. When this is done, the accumulating collar (Fig. 4) for the counters, carrying accumulating totals, should be disengaged to the left.

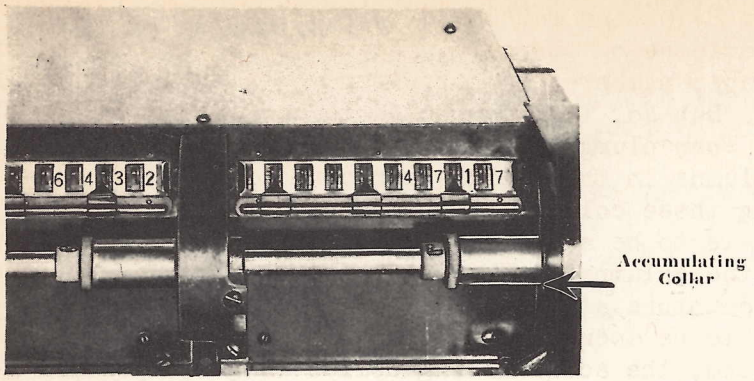
The plugboard hubs marked "CC" indicate the card-counting connection which permits the counting and accumulating of all cards passing through the machine except stop cards.



Model 3 Plugboard
FIG. 2



Type 92 Plugboard Wired for Adding
FIG. 3



Counter Accumulating Collar- Collar Engaged
FIG. 4

GROUP INDICATOR

All standard tabulators are equipped with a group indicating device, which provides for indicating on one of the regular counters the classification number of each group of cards passing through machine. This device is attached to the side of the last counter (at the right of the machine).

Two counters of group indication (first and second) is standard on the three-counter tabulator. Three counters (first, second, and third) is standard on the five-counter tabulator.

RESET MECHANISM

The machine is set to zero by the reset mechanism which is placed on a platform attached to the right end of the base. Briefly, this consists of a shaft which is clamped to and forms an extension of the regular reset zero shaft, a motor, and a universal joint and worm gear connecting the motor shaft to the extension shaft.

The resetting device is operated by depressing the reset key, which is located at the right of the stop key. At the completion of the reset cycle, the tabulator will start automatically.

GENERAL

Before starting to operate the tabulator, the operator should be familiar with the start, stop and reset keys, the main switch, the card pressure plate, and the card stacker.

The position of the machine is important. It should be so placed that the operator has good light at the front, and on the counters of the machine.

It is also well to have the machine easily accessible on all sides.

Operation - The tabulating cards, having been punched and sorted, are ready for tabulation and the plug wires must be placed in their proper hubs in the plugboard to permit tabulation in any desired counter. Fig. 5 shows a typical Sales Analysis card with the various punched data appearing on the counters. After having connected the plugboard of the machine (see Fig. 3), a card diagonally punched from 1 to 9 should be run through and read against the dials to determine whether the machine has been set up correctly. This should be done before running a group of cards through the machine, thus guarding against the possibility of wrong results due to the machine being set up incorrectly.

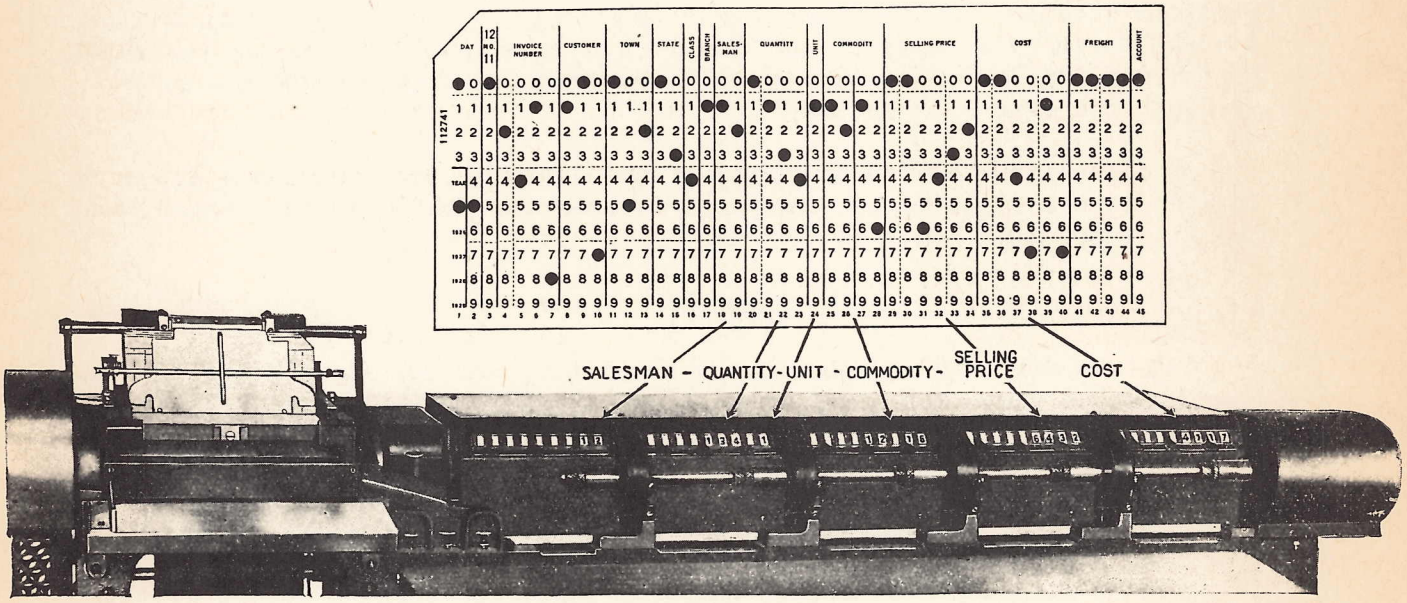
When the machine is ready to run, take a sufficient quantity of cards to fill the magazine two-thirds full and carefully true them up on the joggle plate. Place the cards in the magazine with the right hand, the printed side toward the feed knife, and firmly press the pressure plate against the cards. Depress the start key and the machine will start running.

When changing from one set-up to another, always turn off the main line switch. Also make sure that all of the unused plugboard wires are removed. Do not let one end hang loosely, touching the base or adjacent plug wires, because it will be impossible to obtain correct results from the machine if a plug wire is grounded to the frame.

No more cards than can conveniently be removed with one hand should be allowed to collect in the card stacker. On long runs, totals should be transcribed after about every two thousand cards to prevent having to re-tabulate the whole run in case of accident.

GROUP INDICATOR OPERATION

When using the group indicator, a stop card must be placed after each group. A stop card is a tabulating card having the lower left corner cut out, its purpose being to stop the machine. When the same classification



Preparation of Sales Analysis
FIG. 5

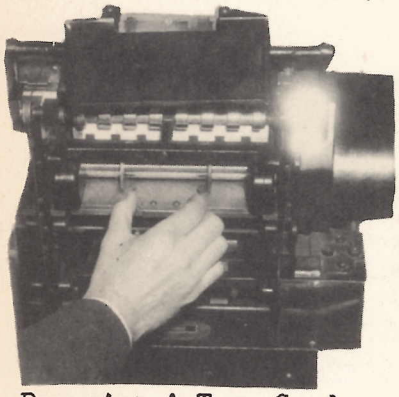
numbers appear regularly, the stop cards can be punched and placed in their position by the sorting machine, by putting them in front of the regular cards on the initial sort. In other cases they are put in by hand, using the sorting needle for picking off each group. Lay the group of cards face down, placing a stop card on top with the cutout portion at the lower left corner.

When the machine is stopped by the stop card, post the figures from the counters and press the reset key. This clears the counters to zero and starts the machine tabulating the next group.

CORRECTIVE DATA

Care of Brushes - The contact roll, as well as other parts of the feeding mechanism, must be kept clean. If it is necessary to remove or replace the contact roll, be very careful not to damage any of the brushes, because damaged brushes will cause erroneous results on the counters. Make sure when replacing the contact roll that it is fully seated in position and that the catches are fully engaged in the holes.

Removing Torn Card - To remove a card caught in the feeding mechanism, proceed as follows: First, turn off the main switch on the machine. Next remove the contact roll assembly (see Fig. 6), handling it carefully, and separate the feed rolls by using the feed roll hook provided. The torn or damaged card may then be readily removed. After using the feed roll hook, make certain that the feed roll gears are meshed properly after the damaged card has been removed. If the feed roll gears are not meshed properly, cards will feed crooked, which will cause erroneous results on the counter.



Removing A Torn Card
FIG. 6

Miscellaneous Corrective Data - (1) If machine will not run when start key is held down or reset when reset key is depressed. (A) Wall plug not in. (B) Main line 3-ampere fuse blown.

(2) If machine will not run when start key is depressed but reset will operate. (A) Blown or broken drive motor fuse.

(3) If machine will run but not reset. (A) Blown or broken reset motor fuse.

(4) If machine runs, feeds cards and resets but fails to add any figures on the counters. (A) Blown or broken control (marked "C") fuse.

(5) If one counter fails to add. (A) Counter fuse may be blown or broken. Note: Make certain that all plugboard wires are tight.

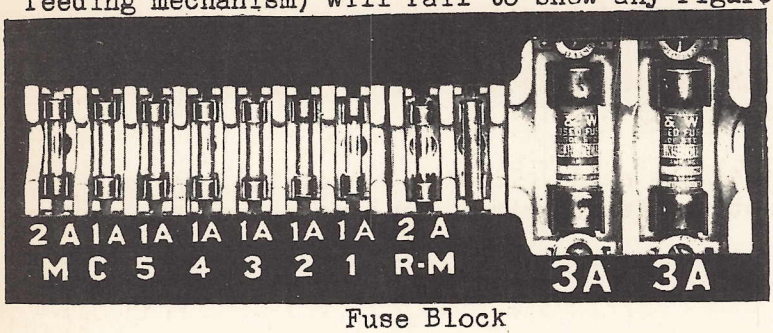
(6) If one particular adding wheel fails to register. (A) Broken or loose plugboard wire.

(7) If one position fails to accumulate, i.e., carry from one wheel to the next. (A) Carry lever spring or spring link broken.

FUSES

Fig. 7 shows the fuse block with indications as to the capacity of the various fuses. Never use a fuse of a capacity other than that indicated on the fuse block. If either of the main line 3A cartridge fuses are blown or

broken, the machine will not operate at all. If the 2A "R.M." glass fuse is blown or broken, the automatic reset will fail to operate. There are five fuses each of 1-ampere capacity and marked 1-2-3-4-5. These fuses control the addition or indication, as the case may be, on the respective counters. For example, if No. 3 fuse is blown or broken, the third counter (from the feeding mechanism) will fail to show any figures upon its dials. Similarly, if No. 5 fuse is blown or broken, the fifth counter will not operate. The fuse marked "C", of 1-ampere capacity, controls the operation of all five counters. If it is blown or broken, none of the five counters will function. The 2A "M" glass fuse controls the drive motor circuit. If it is blown or broken, the drive motor will not function.



Fuse Block
FIG. 7

A blown fuse can be noted by the discoloring of the glass tube, caused by the flare.

A broken fuse is sometimes difficult to detect, as the break is not always visible. When in doubt, replace the fuse.

Two styles of fuses are used, namely, glass and cartridge.

The cartridge fuses are larger and have a fibre cover instead of glass and are not to be confused with the resistance coils mounted inside the base of the machine.

ELECTRIC TABULATING MACHINE - GENERAL

Remove the contact roll assembly before attempting to take out cards caught in the feeding mechanism.

Never attempt to turn the machine backwards except in case of real emergency, such as when a careless person gets a foreign substance caught in the machine. In such a case, simply release the reverse friction pawl that engages the drive belt wheel, and the machine can be turned backwards by hand.

The driving belt may be adjusted by lowering the drive motor board.

"DON'TS" FOR THE OPERATOR OF THE ELECTRIC TABULATING MACHINE

1. Don't leave the power turned on when the machine is not in use. This wastes electrical energy and causes unnecessary heating of the coils, etc.

2. Don't fail to put the cover over the feeding mechanism when the machine is not in use. This is to keep out dust, dirt, and other foreign substances.

3. Don't leave the plugboard or fuse block door open. These doors are to prevent foreign materials entering the machine.

4. Don't leave plug wires plugged in the machine on one end and the other dangling and possibly touching the iron frame (causing a ground) or adjacent plug wires (causes a short circuit).

   Remember, remove all of the unused plugboard wires, otherwise the machine may give erroneous results.

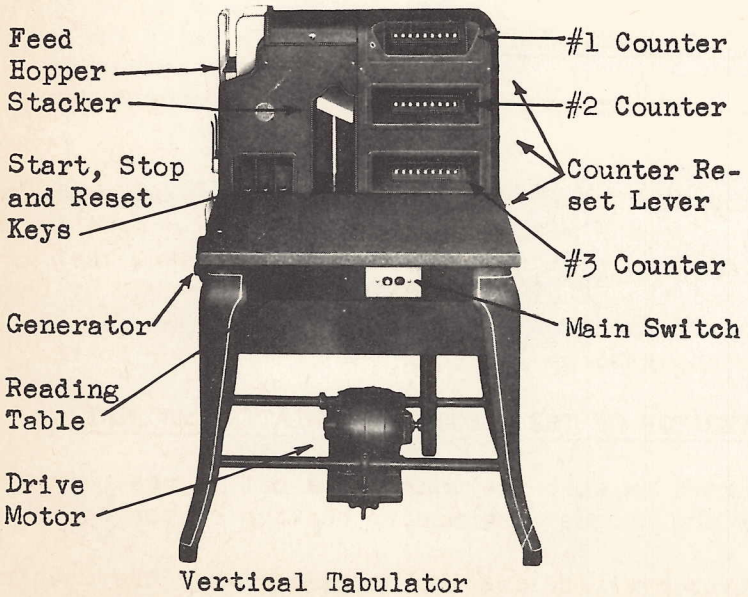
5. Don't foreget that this machine needs cleaning and oiling regularly, but in doing so be careful not to disturb wires, or damage brushes, springs, etc.

6. Don't call a Customer Service Representative until you have made certain that the trouble is not due to wrong plugging, blown or broken fuses, start, stop, or reset keys stuck down, switches thrown the wrong way, wall plug not in, etc.

7. Don't be careless about operating this machine; follow instructions, thus preventing errors and delays.

TYPE 91 VERTICAL TABULATOR

The vertical tabulator is a multiple adding machine by means of which punched cards are made to yield totals. It is used to indicate classification and to total amounts recorded in the various classification and adding fields of the card. It is a non-listing machine, which means that all classifications and accumulations are transcribed by the operator from the reading dials of the machine to the final reports.



Vertical Tabulator
FIG. 8

From one to three groups of figures are added by this machine in three counters, each with eight adding and one accumulating positions. The counters are cleared manually by the levers shown in Fig. 8 on the side of the counters. The first (top) counter is wired for optional group indication in either the first four positions to the right or all eight positions. The tabulator operates at 90 cards per minute, or 16,200 additions an hour.

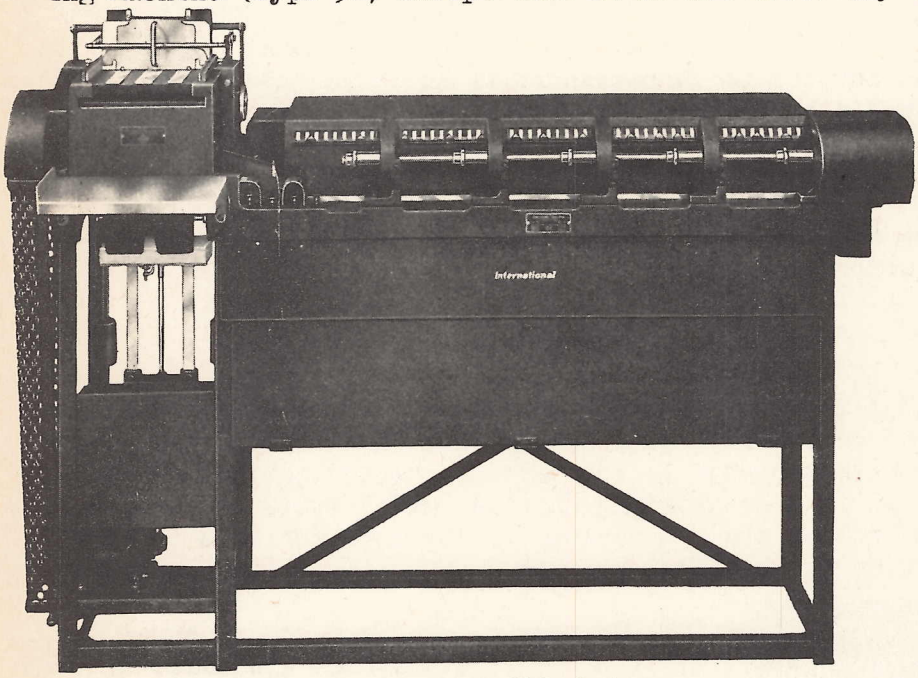
The machine is equipped with a non-automatic plugboard, similar in principle to a telephone switchboard, which renders it entirely flexible for all tab-

ulating requirements. A stop card causes the machine to stop at the end of each classification or group so that the operator may record the totals of that group. All control keys are placed in such a way that the operator may sit comfortably at the reading board and conveniently operate the machine.

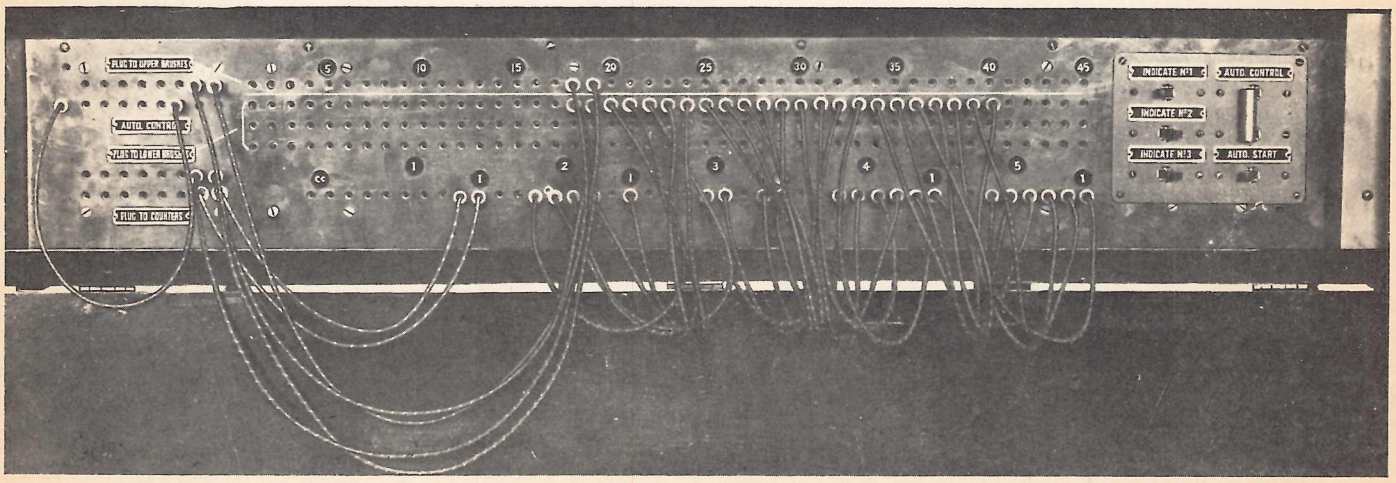
The Vertical Tabulator is made for 45-column cards only, and may be made to operate at 110 or 220 volts, either direct or alternating current.

TYPE 93 AUTOMATIC CONTROL TABULATOR

This machine is used in exactly the same manner as the Electric Tabulating Machine (Type 92) except that it is not necessary to use stop cards. The electric automatic control with which this machine is equipped functions so that at the end of each group the machine stops and the totals can then be posted from the counter dials. The only difference in the appearance of this machine as compared with the standard tabulator is that the feeding mechanism is "double decked"; that is, there are two sets of brushes, etc., which are necessary because of the automatic control feature.



Automatic Control Tabulator
FIG. 9



Plugboard of Automatic Control Tabulator
FIG. 10

The plugboard illustrated in Fig. 10 is wired or plugged to tabulate the data shown on the typical sales analysis card illustrated in Fig. 5. The machine is arranged to control on "Salesman." Notice the position of the shunt plug, which is shunting out the six positions not being used. The control will function on a maximum of any eight digits on the card.

It will be noticed, upon referring to Fig. 10, that there is a switch marked "Auto Control." When this switch is to the left the control is operative and when it is set to the right the control feature becomes inoperative. However, when the switch is in the latter position the machine can be used as a Type 92 tabulator and, if desired, stop cards used, thus making the machine operate the same as a non-automatic control.

The group indicating feature on this machine is somewhat more flexible than on the Electric Tabulating Machine. It is possible to add and indicate on the same counter at the same time if the total number of adding and indicating digits does not exceed eight. Furthermore, it is possible to use this split feature on any one of the first three counters. If this combined indicating and adding feature is used, the group indicating switch for the counter being so used must be "off" or to the right. To "plug" the machine for this feature, connect the indicating "field" from the desired lower brush plugboard hubs, to No. 3 row of hubs in the control unit side of the plugboard and from No. 4 row of hubs to the counter side of plugboard beginning with the units position (see Fig. 10). Make certain that the same sequence of plugging is followed. The adding "field" would be connected from the desired lower brushes to the remaining counter plugboard hubs.

Remember, it is important that the group indicating switch, for the counter being so used, must be to the right.

The automatic control feature on this machine will function only where there is a punched hole from 9 to 0 in each column of the controlling "field." The control will not operate on holes punched in the 11th and 12th positions, neither will it function on double punching, that is, two holes punched in the same column, or in a blank column.

The same general instructions apply to this machine as to the Electric Tabulating Machine (Type 92).

ELECTRIC AUTOMATIC CONTROL TABULATORS EQUIPPED WITH MAJOR AND MINOR CONTROL

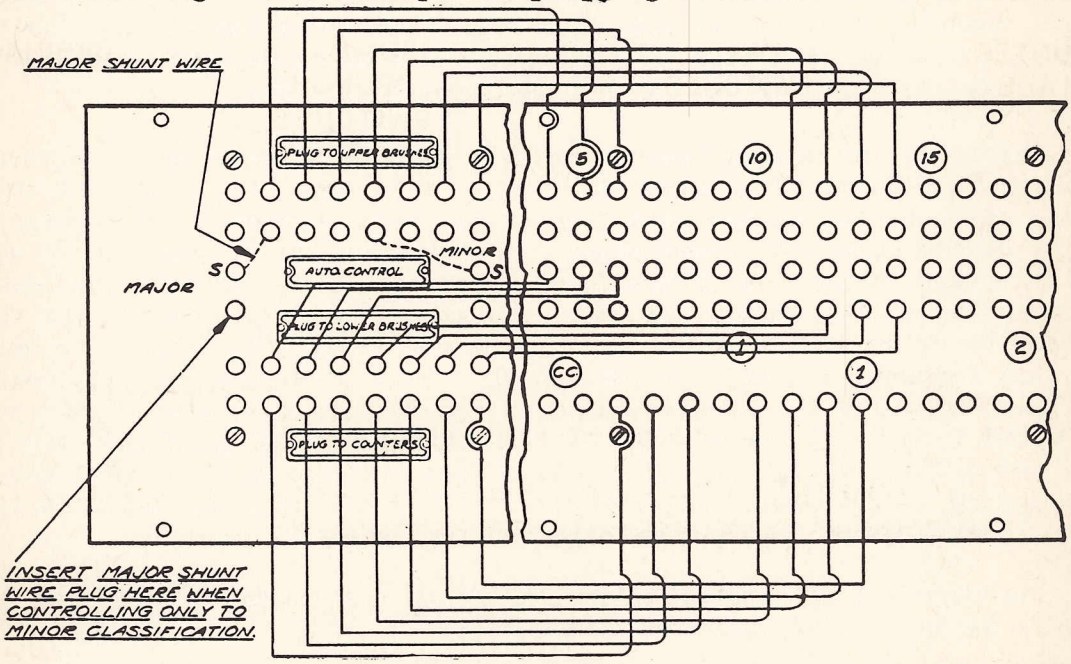
The control will function on two different fields simultaneously, the machine automatically sensing the field in which the change occurs.

There are four operating keys on this machine, namely: start, stop, and reset keys, with the addition of a major-total reset key located to the right of the regular reset key.

If the control change occurs in the minor field, the machine will come to a stop. The counter dials can be cleared and the machine automatically started by depressing the regular reset key. When a change occurs in the major field, the machine will come to a stop and fail to reset from the

regular reset key. This gives the operator a signal, before depressing the major-total reset key, to engage the accumulating collar on the counter from which the grand total is to be taken. The reset can only be operated from the major-total reset key when the major group changes. In other words, the machine must be reset from the regular reset key on each change of the minor group and only from the major-total reset key when the major group changes.

Refer to Fig. 11 for example of plugging control.



Example of Plugging of Major-Minor Control Card Columns 4-5-6 Plugged to Major Control and to Indicate on Left Side of No. 1 counter. Card columns 11-12-13-14 Plugged to Minor Control and to Indicate on Right Side of No. 1 Counter.

Automatic Control Tabulator
FIG. 11

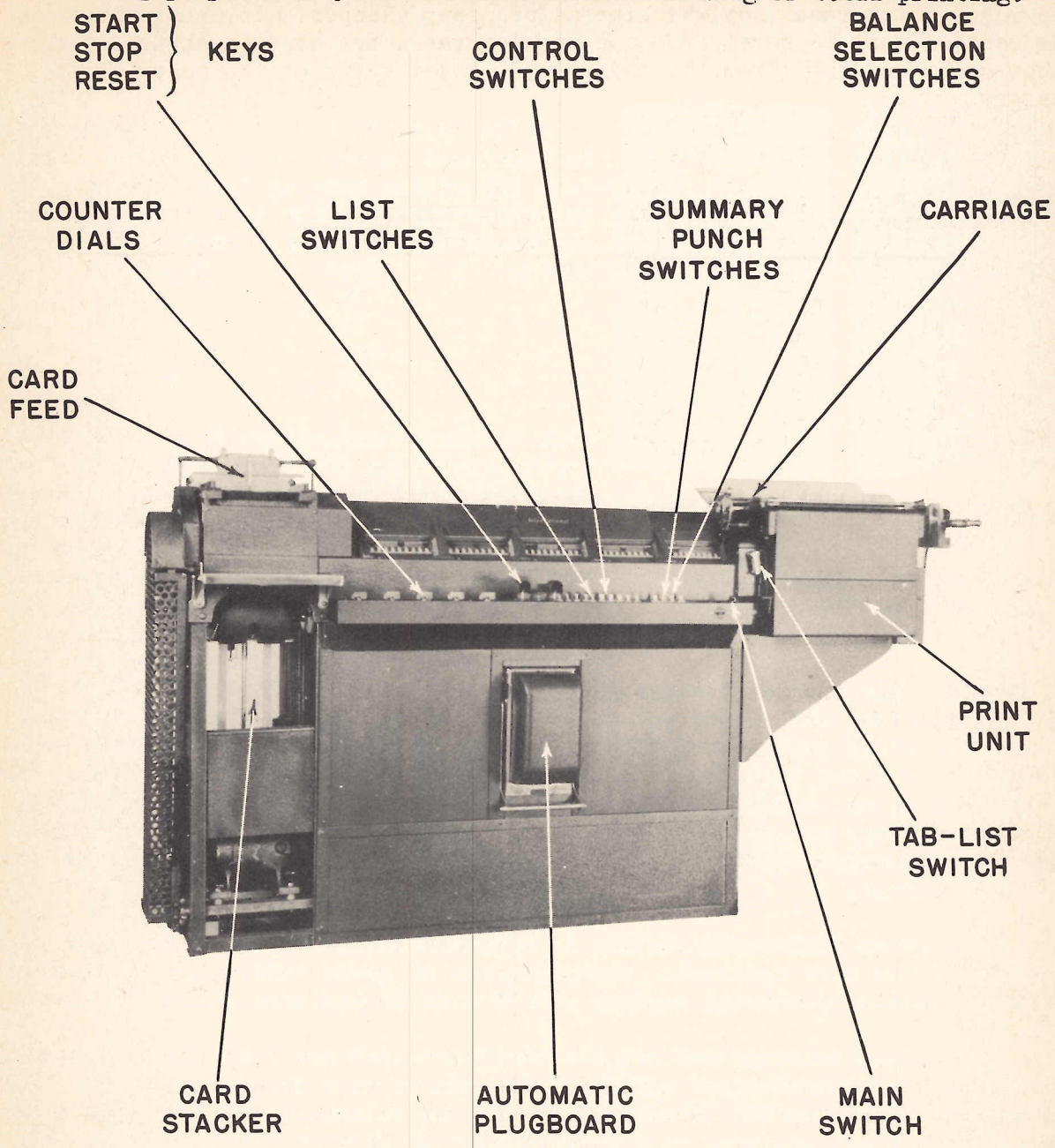
Note position of shunt plugs. When not using major control feature, always make sure that the major shunt plug is in its socket to left of plugboard. Otherwise, machine will not keep running.

TYPE 285 ELECTRIC ACCOUNTING MACHINE

The Type 285 Printing Tabulator is used to indicate, total print, and list the various information recorded on the punched card; the counters and printing banks operating simultaneously. Each of the five counters has an adding capacity of eight digits and a listing and accumulating capacity of nine digits. Balance counters have nine magnets, with a capacity of nine positions for listing, adding, and accumulating, and eight positions for balance printing.

All machines, regardless of the particular capacity ordered, are basically wired for installation of seven print banks. The seven-bank machine

has five adding or balance counters and corresponding type banks, as well as two additional banks of ten type bars which can be used for controlling or indicating purposes only and function whether listing or total printing.

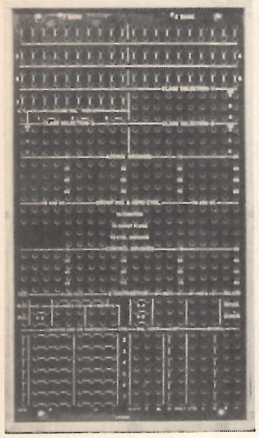


Type 285 Electric Accounting Machine
(Printing Tabulator)
FIG. 12

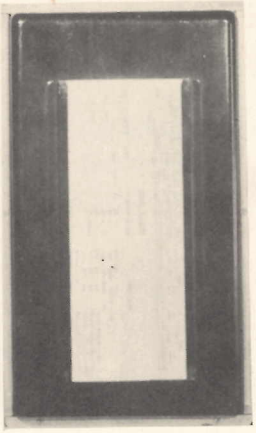
These two additional banks of type bars do not have adding or accumulating features.

Banks No. 1 and No. 2 are list banks. Banks No. 3 and No. 4 are counter banks. Banks No. 5 to No. 7 may be either counter or list banks. Bank No. 3

may have 11 type bars; all other banks have 10 type bars. Bank Nos. 1, 2 and 3 are 10-position list; all other banks are 9-position list. All machines are equipped with symbol printing control which provides for the printing of an asterisk (*) and a credit symbol (CR) in the No. 1 bar and an asterisk in No. 10 bar in all of the counter print banks. Fig. 13 shows the two types of automatic plugboard on this machine.



MANUAL SET-UP SLIDE



FIXED SET-UP SLIDE

Two Types of Automatic Plugboard on Type 285 Machine
FIG. 13

The Type 285 Electric Accounting Machine is furnished in various counter and print bank capacities ranging from a two-counter and three-bank machine to a five-counter and seven-bank machine. Speeds are as follows:

List	Tabulate
75	75
75	150
120	120
120	150

This tabulator automatically adds or lists and total-prints the various data on a tape or ruled final report. The machine is also equipped with an automatic control feature which eliminates the use of stop cards, making it necessary merely to sort the cards into the desired group and place them in the printer for tabulation, with the resultant saving of time and assurance of accuracy. The control feature functions on any of the digits from zero to nine inclusive, and on any column or group of columns on the card. Either 6 or 16 positions is standard on the Type 285 Tabulator, with major and minor control. A third control, intermediate, is available where specified. The major and minor control feature makes possible the holding of grand totals in the counters and printing them at the end of a major group. All counters are cleared magnetically and are controlled by the counter dials on the front of the machine.

The group indicating feature is arranged so that it will function on any or all of the five counters. Ten positions of group indication is standard with 6-position automatic control and 20 with 16-position automatic control.

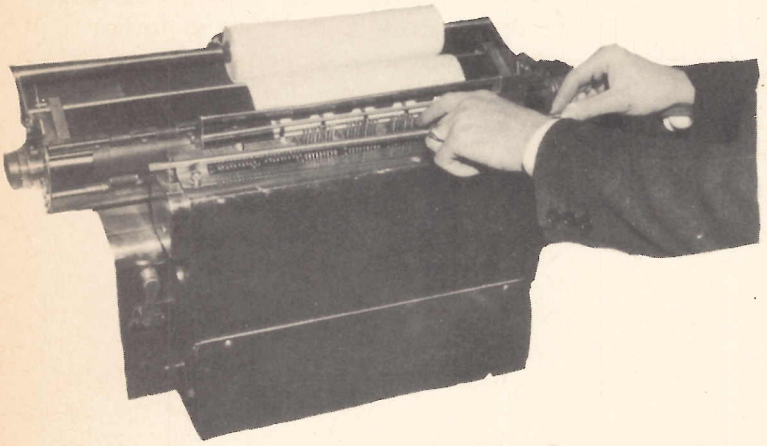
One class selector and one X-distributor unit are furnished as standard equipment only on machines equipped with one or more balance counters. Where specified, any Type 285 Tabulator may have an automatic summary punch attached. All machines are equipped with stacker stop to prevent overloading of the stacker.

The card counting connection permits the counting of all cards, in any counter, passing through the machine.

The carriage is similar to a 20" typewriter carriage and is arranged to accommodate a sheet of paper 20" wide. Standard typewriter spacing is used, six single spaces to the inch or three double spaces to the inch. When de-

signing forms to be used in the printer, allow 1-7/8" between vertically ruled lines to separate one type bank from the next. A superior grade of 1/2" typewriter ribbon is used.

The hammer lock feature, as shown in Fig. 14, makes possible the suppression of the printing of a type bar. For example, if it is desired to eliminate all the printing in banks 1 and 2 and the asterisks in banks 3 and 4, the hammer locks are pushed down and held in place by the hammer lock bar as shown in the figure.



Setting the Hammer Locks
FIG. 14

Operation of Type 285 Tabulator

After having wired the automatic plugboard and inserted it in the machine, a card punched diagonally from "1" to "9" should be run and read against the counters and printed tape to determine whether or not the machine has been set up correctly. This should be done before starting a tabulation, thus guarding against the possibility of wrong results due to the machine being set up incorrectly. Where class selection, subtraction, and other features are going to be used in the tabulation, cards testing these devices should also be run through the machine.

When starting a tabulation, take a sufficient quantity of cards to fill the magazine two-thirds full and carefully true them on the joggle plate. Place the cards in the magazine with the right hand, the printed side toward the feed knife, and position the pressure plate firmly against the cards. Depress the start key and the machine will start running.

On long runs, totals should be transcribed periodically to prevent having to retabulate the whole run in case of accident.

Before beginning to operate the printer, the operator should be familiar with the start, stop, and reset keys, the main switch, the carriage, the list, control, balance, class selection, summary punch, group indication, and counter dial switches, the automatic plugboard, the card pressure plate, the card stacker, and the printing mechanism.

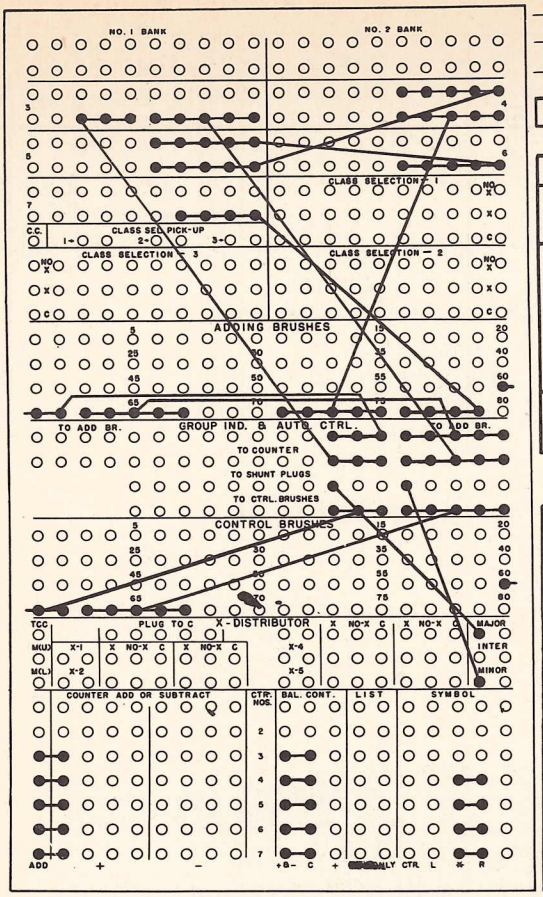
The control will function on two different fields simultaneously (three, if equipped with intermediate control), the machine automatically sensing the field in which the change occurs. If the change occurs in the minor control field, the machine will print the total from those counters whose dial switches are set to "minor" and reset the same counters and start automatically. If the change occurs in the major control field, both the minor and major controlled counters will print and clear.

	Counter 1		Counter 2	Counter 3	Counter 4	Counter 5
Sales-man	Product No.	Class	Product Totals	Salesman Totals	Grand Total All Salesmen	Cost of Sales
32	01	01	873			
32	02	01	903			
32	03	01	1649			
32	04	02	1850			
32	05	02	1516	6791*		
33	01	01	3340			
33	02	02	630			
33	03	01	567			
33	04	01	823			
33	05	01	213			
33	06	01	223	5796*		
34	01	01	263			
34	02	03	2256			
34	03	04	1075			
34	04	01	1718			
34	05	02	969			
34	06	04	1213			
34	07	01	309			
34	08	02	1275	9078*		
35	05	01	1773			
35	06	01	1606	3379*	25044*	18450*

Example of Sales Analysis
FIG. 15

Referring to Fig. 15, the illustration shows the "major" or principal group number control to be on "Salesman," and the so-called "minor" groups controlling on "Product." Salesman and Product are group-indicated in counter No. 1. In counter No. 2 the "amount" for each product is shown. This counter dial switch is set to "minor" and the total in this counter is printed and the counter cleared every time the product changes. In counter No. 3 the total of all the products sold by a certain salesman is indicated. The counter dial switch in this case is set to "major" and the total from this counter is only printed when the salesman number changes. On a major change this counter is automatically reset and the machine starts on the next salesman group.

A grand total for all the salesmen, or total sales, is kept in counter No. 4, and no totals are printed on either major or minor control changes. The counter dial switch is set to "off" during the tabulation and is set to "minor" and cleared after the last card has gone through the machine. Counter No. 5 represents "Cost of Sales" on all products sold by all the salesmen. The counter is controlled the same as counter No. 4.



Sales Analysis by Salesman

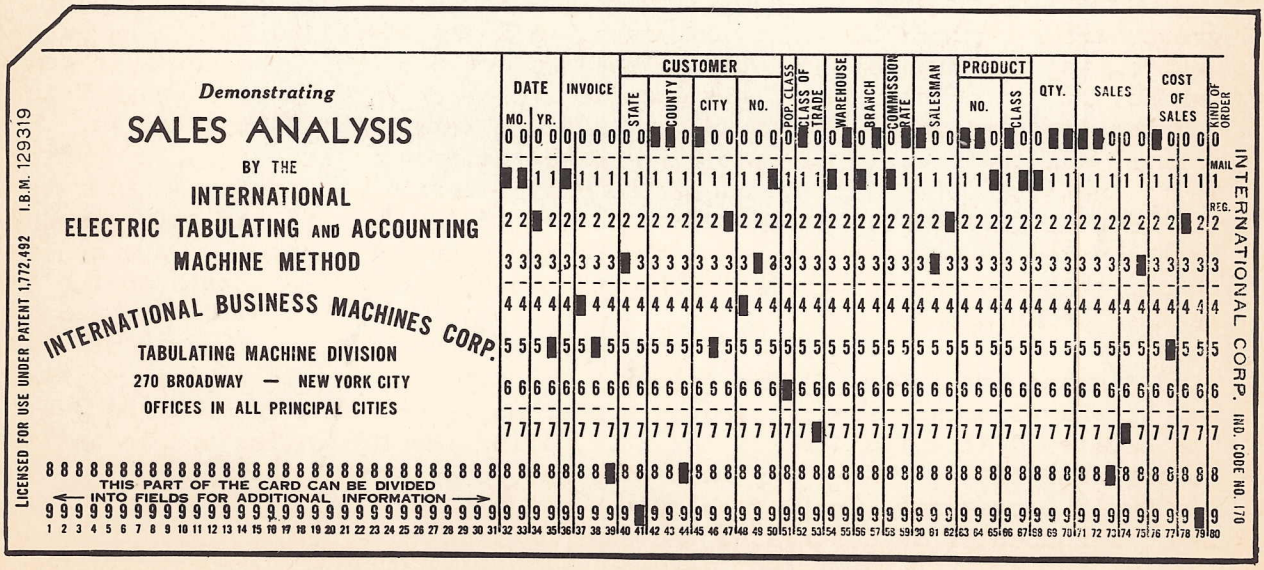
and Product

TABULATE	X	LIST	

BANK			1	2	3	4	5	6	7
LIST	LIST	OFF	X	X	X	X	X	X	X
	IND.	ON							
TOTAL		OFF						X	X
		PROG.							
		MIN.			X	X			
		INTER							
		MAJ.					X		
BALANCE		OFF			X	X	X	X	X
		ON							

MISC. SWITCHES	OFF	ON
AUTO START		X
AUTO RESET		X
AUTO CONTROL - MAJOR		X
- INTER		
- MINOR		X
GROUP INDICATOR		X
SUMMARY PUNCH	X	
S.P. AUTO RESET	X	
S.P. MAJOR	X	
S.P. INTER	X	
S.P. MINOR	X	
SUCCESSIVE RESET	X	

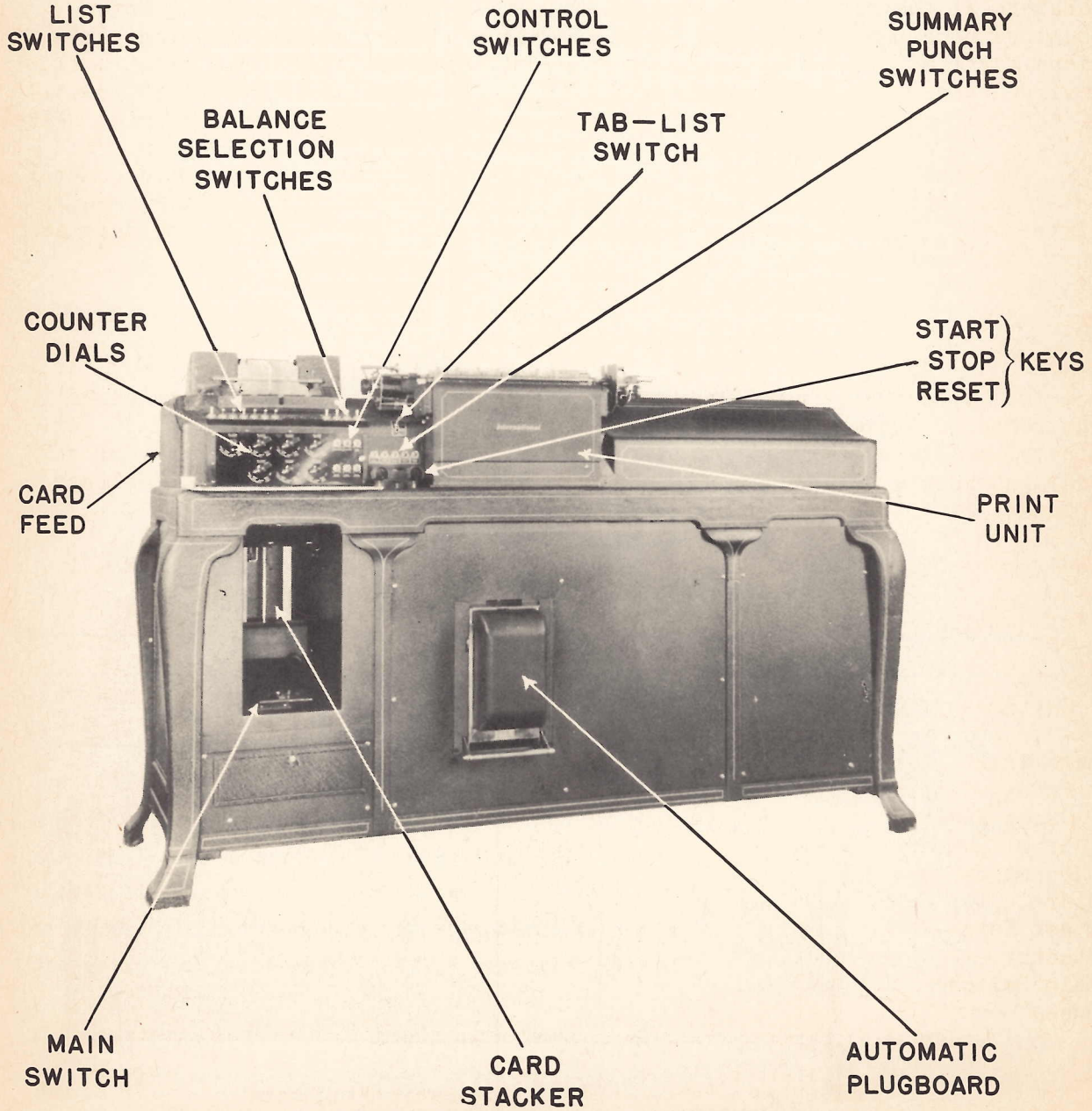
Plugboard of Type 285 Wired for
Sales Analysis (Card Fig. 17)
FIG. 16



Sales Analysis Card
FIG. 17

It is important to remember that only the minor shunt plug should be used when the control is being operated as a single control. It must also be remembered that if the machine is arranged to control on only four positions, the minor shunt plug must be placed in the No. 4 hub from the right in the row marked "to shunt plugs."

For example, to set the machine for the report shown in Fig. 15, the plugboard is wired as in Fig. 16. The position of the switches is indicated in the table to the right of the plugboard. The successive reset switch, if in the "on" position, will, on a major change, cause the machine to take two successive reset cycles. The minor totals will be cleared on the first



Type 297 Electric Accounting Machine
FIG. 18

cycle and major totals on the second. The major totals will be printed on the next space after the minor totals.

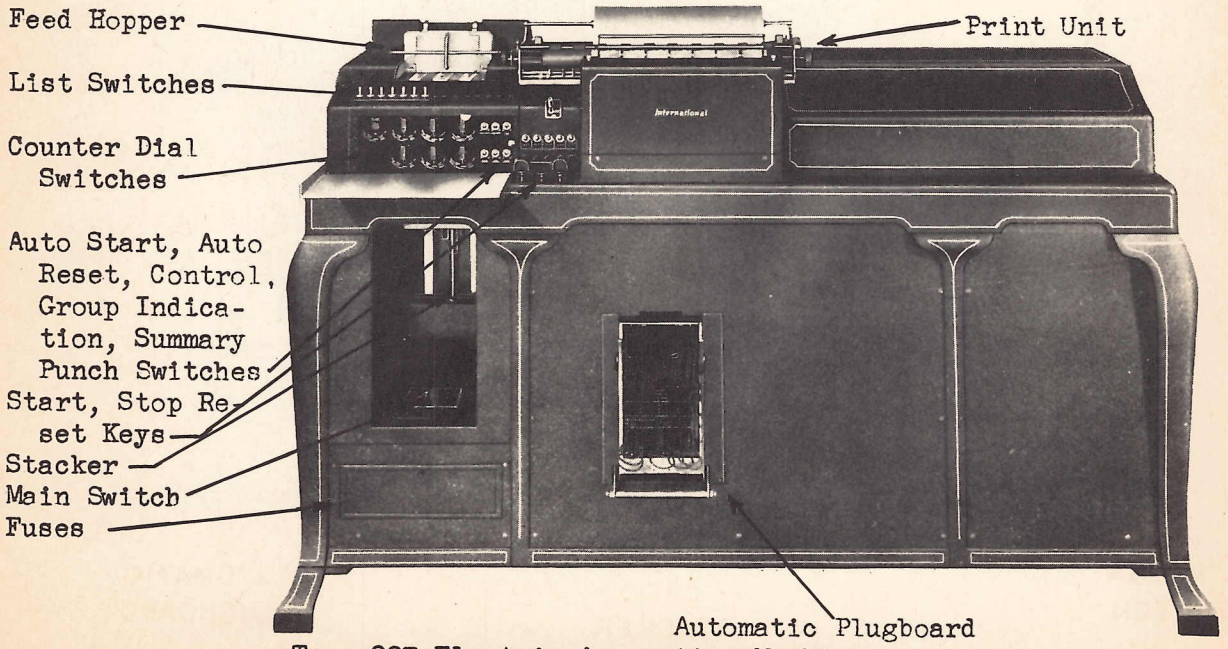
TYPE 297 ELECTRIC ACCOUNTING MACHINE
(Standard, Adding and Direct Subtraction)

The Type 297 Electric Accounting Machine is a multiple adding, subtracting, classifying, and printing machine, which, actuated by punched tabulating cards, produces printed tabulations. It will list details from individual cards or will print designations and totals, net totals, and accumulated net totals. This machine will list cards at the rate of 100 per minute and tabulate at the rate of 150 cards per minute. It has a capacity of seven counters of either the adding or balance type. All counters have ten positions for listing, adding, accumulating and total printing. The print unit having seven print banks may have one list bank and six counter banks, or if the full counter capacity of the machine is used, seven counter print banks.

The Type 297 has as standard equipment 16 positions of automatic control on minor, intermediate, and major; 20 positions of group indication, one X-distributor, and one class selector. The automatic plugboard is the same as that used on the Type 285.

TYPE 302 ELECTRIC ACCOUNTINC MACHINE
(Special - Adding Only)

The Type 302 differs from the Type 297 in that it does not have direct subtraction. This machine will list individual cards at the rate of 75 per minute, and tabulate 150 cards per minute. It has a counter capacity of six adding counters - two with nine magnets and four with ten magnets. Balance counters cannot be installed in this machine.



Type 297 Electric Accounting Machine
FIG. 19

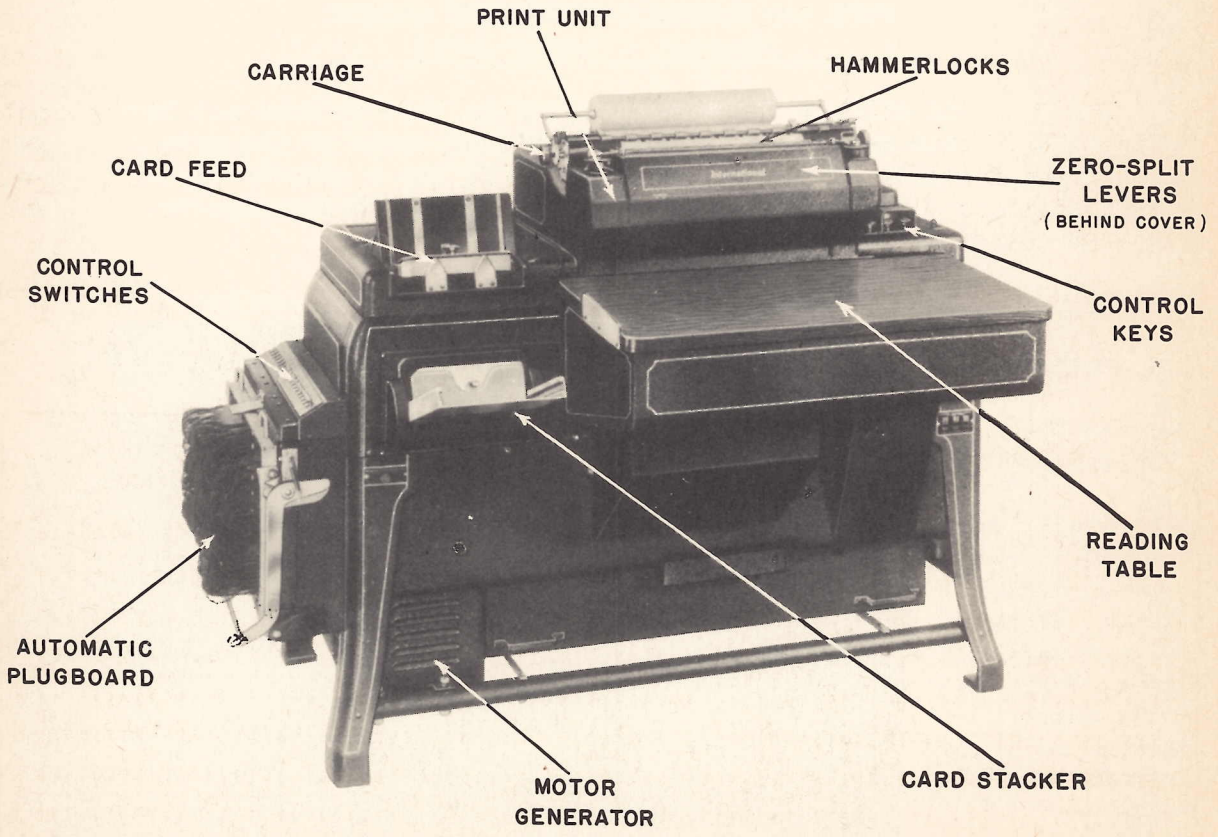
The print unit has a capacity of seven print banks. No. 1 bank is a list bank with ten-position list; No. 2 and No. 3 banks are counter banks with nine-position list and total print with asterisks; No. 4 to No. 7 banks are counter banks with ten-position lists and total print, no asterisks.

The carriage on this machine has the standard 20" platen and a Quick Insert Device to enable the operator to position rapidly a standard form with printed heading.

The Type 297 also has as standard equipment 16 positions of automatic control, minor, intermediate, and major, 20 positions of group indication, when summary punch is installed, 3 ten-position class selector units, stacker stop, and single and successive resets. The automatic plugboard with this machine is the same as used on the Types 285 and 297.

TYPE 405 ALPHABETIC DIRECT SUBTRACTION ACCOUNTING MACHINE

The Alphabetic Accounting Machine automatically lists, tabulates and prints alphabetic and numerical information that has been recorded on tabulating cards. Its flexibility and alphabetic feature make it adaptable



Type 405 Alphabetic Direct Subtraction Accounting Machine
FIG. 20

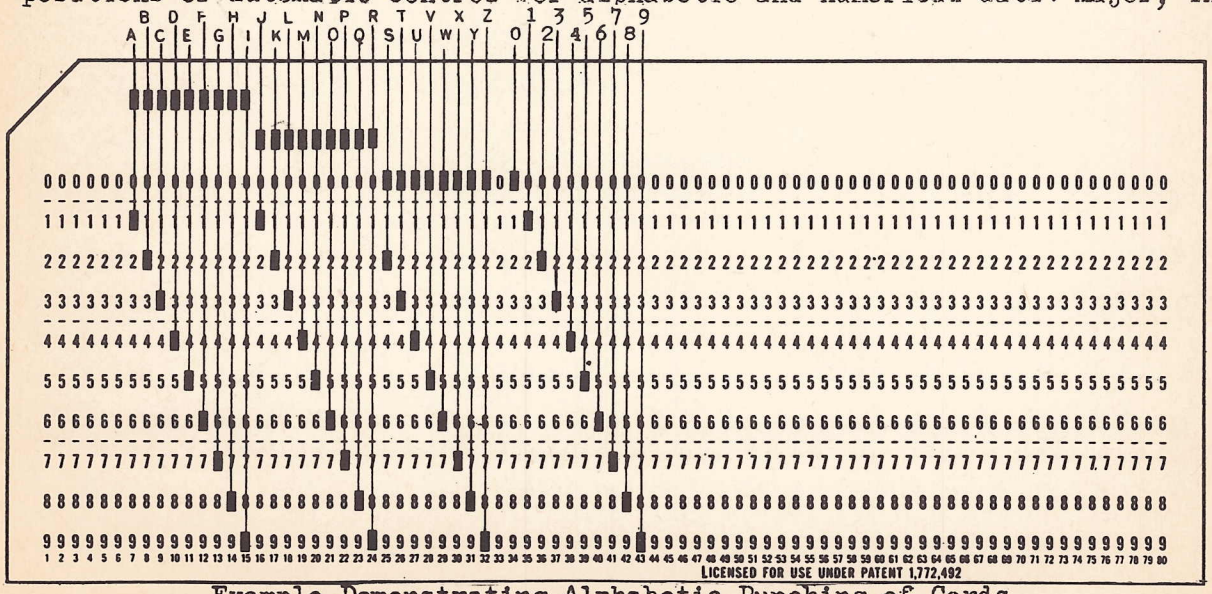
to the preparation of bills, invoices, accounts receivable statements, physical inventory lists, stockholders' records, classified lists, directions, address labels, packing slips, etc.

The print unit of the machine consists of two type sections: the left section is used for listing or indicating either alphabetic or numerical data, or for printing numerical totals; the right, consisting of 45 type bars, is used for listing, indicating, adding, and total printing numerical data. The left section has 43 type bars, each of which is capable of printing all of the characters of the alphabet and all of the digits without the use of any combined characters. Numerical type bars have an asterisk (*) on the odd-numbered bars and a credit symbol (CR) on the even-numbered bars. All type bars have individual zero-split levers. Zeros to the right of significant figures in an amount print only under control of zero-split levers. This machine is also equipped with manual and automatic hammer lock control which prevents the hammer from striking the type bar if no figure is to be printed.

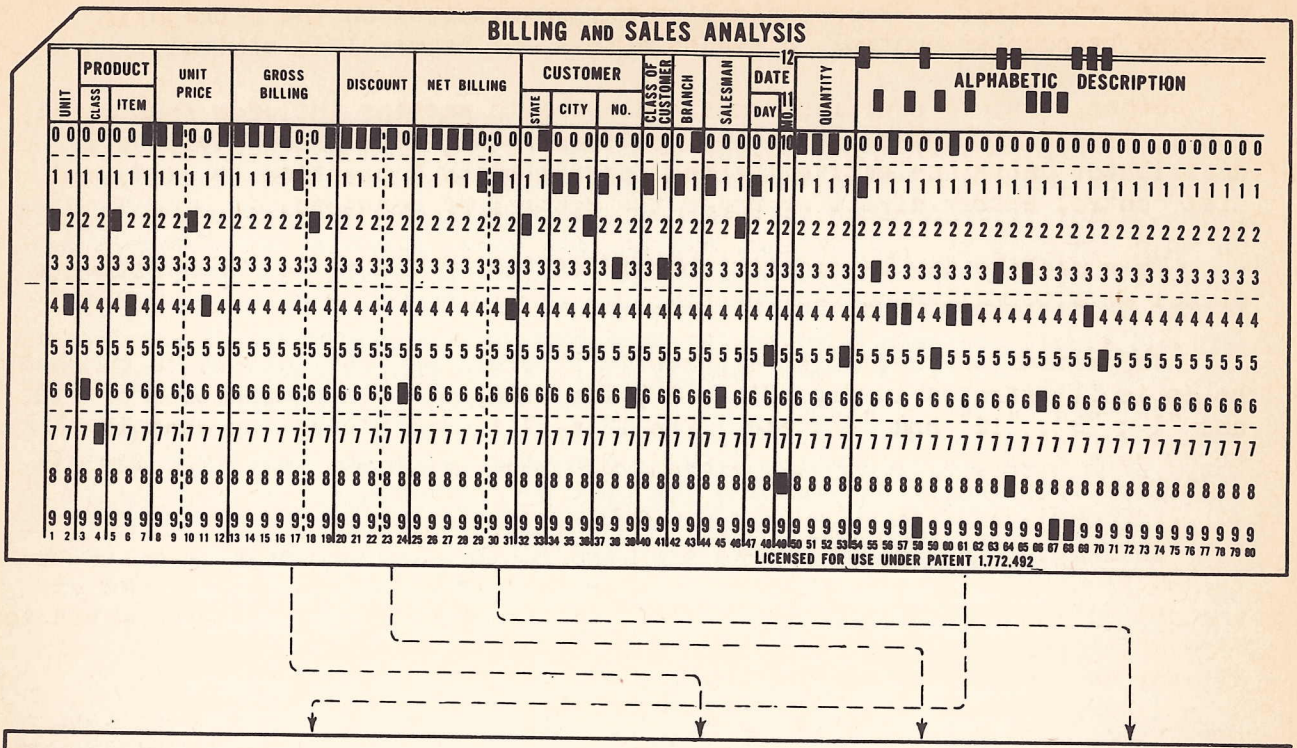
This machine is designed for use with the 80-column card only and is made in two sizes, 56 and 80 counters. The speed ratings obtainable in the Type 405 machine are 80 list, 80 tabulate and 80 list, 150 tabulate.

All counters in the alphabetic accounting machine are capable of addition and direct subtraction. To make controlling easier and eliminate needless wiring, the counters are grouped. On the 56-counter machine they are grouped in four of two-position units, four of four-positions, four of six-positions, and one of eight-positions. The 80-counter machine is grouped in four of two-positions, four of four-positions, four of six-positions, and four of eight-positions. Any of the counter groups on either machine can be coupled together to form single-acting counter groups of greater capacity.

This machine is equipped with a standard 20" platen, single and double spacing and standard spacing of six single spaces per inch. There are 20 positions of automatic control for alphabetic and numerical data: major, inter-



Example Demonstrating Alphabetic Punching of Cards
FIG. 21



BILLING & SALES ANALYSIS

PRODUCT NAME	GROSS BILLING	DISCOUNT	NET BILLING
ALUMINUM CHLORIDE	391360	72840	318520
CITRIC ACID	45345	2721	42624
CODEINE SULPHATE	452276	27137	425139
DICHLORICIDE		7626	68629
ETHYL ALCOHOL		8397	601555
ETHYL COMPOUND	5482	548	4934
FERROUS OXIDE	15245		15245
MILK SUGAR PWD	94620	946	93674
MORPHINE SULPHATE	284374		284374
POTASSIUM BROMIDE	6623	66	6557

HAMMERSPLITS SET
HAMMERSPLITS RAISED

Example of Billing and Sales Analysis Obtained from an Alphabetic Direct Subtraction Accounting Machine
FIG. 22

mediate, and minor. Group indication may be obtained on the alphabetic machine by counter control, class selectors, or hammer-lock control.

Other standard equipment on the alphabetic machine includes four class, total, or balance selectors of ten positions each, five three-position X-distributor units, selective listing controlled by X position in card, and list control either direct or under the control of counters.

This machine may be made to operate on 110 or 220 volts, from either a direct or alternating current supply.

The method of converting alphabetic information from letters to punched holes is illustrated in Fig. 21. "A", for example, is a combination of "12" and "1"; "B", "12" and "2"; etc. The 12's, X's, and 0's set up what is known as a zoning unit and the figure then determines the letter of the alphabet represented by the combination of the two holes.

In Figs. 22 and 23 are shown examples of the type of report that is obtained from an alphabetic machine. It is readily seen from these above examples that the combination of the alphabetic and numerical features makes the Type 405 Alphabetic Accounting Machine a complete, flexible, and efficient all-purpose accounting machine.

STOCK REPORT

STORE NO. 14 WEEK ENDING July 20

CLASS	DESCRIPTION	UNIT	ITEM NO.	OLD BALANCE	RECEIPTS	SHIPMENTS	UNFILLED ORDERS	NEW BALANCE (LESS UNFILLED ORD.)	VALUE OF SHIPMENTS
TIRES	EAGLE SUPER 4 PLY	EACH	1201	20	40	54		6	34290
	EAGLE SUPER 6 PLY	EACH	1202	10	12	18	8	4a	12510
	SPECIAL X CORD 4 PLY	EACH	1205	6	48	40	6	8	26000
	SPECIAL X CORD 6 PLY	EACH	1206	14	10	21	6	3a	15750
	SPECIAL X CORD 8 PLY	EACH	1207	4	24	12	12	4	10800
	ACME GOLD STRIPE 4 PLY	EACH	1210	24	48	60	24	12a	43500
	ACME GOLD STRIPE 6 PLY	EACH	1211	17	20	24	2	11	19440
									162290.
TUBES	PARAMOUNT REGULAR	EACH	1301	12	24	30	2	4	3450
	PARAMOUNT HEAVY DUTY	EACH	1302	8	12	14		6	2310
	PARA GUM SINGLE	EACH	1304	14	18	24	12	4a	3000
	PARA GUM SPECIAL	EACH	1305	6	14	12		8	1920
	RITZ BLOWOUT PROOF	EACH	1308	16		6		10	1260
									11940.
LINERS	EAGLE REGULAR	DOZ	1401	4	4	6	4	2a	3600
	EAGLE EXTRA HEAVY	DOZ	1402	4		2		2	1600
									5200.
PATCHES	EAGLE LIGHT 6 INCH	DOZ	1501	6	6	8	2	2	1600
	EAGLE TRUCK 8 INCH	DOZ	1502	10	6	14	2		4200
	ACME 6 INCH	DOZ	1503	2	12	12	6	4a	2760
	ACME EXTRA HEAVY 8 INCH	DOZ	1504	6	7	8		5	2600
									11160.

Stock Report Prepared on Alphabetic Direct Subtraction Accounting Machine

FIG. 23

The automatic plugboard for the alphabetic machine is made up of three sections, each the size of a standard automatic plugboard. This plugboard is standard and is used on both the 56-counter and 80-counter machine. Where the capacity of the machine does not fill the plugboard, the hubs are left "dead."

BUSINESS
INTERNATIONAL
MACHINES

INTERNATIONAL BOOKKEEPING AND ACCOUNTING MACHINES

REVIEW AND SPECIAL DEVICES

LESSON NO.

MANUAL OF INSTRUCTION

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 2—20—5

FACTS ABOUT IBM ACCOUNTING AND BOOKKEEPING MACHINES

1. Give the name and type number of all the accounting machines.

1. Vertical Tabulator - Type 91
2. Standard 3 Counter Tabulator - Type 90
3. Standard 5 Counter Tabulator - Type 92
4. Automatic Control Tabulator - Type 93
5. Electric Accounting Machine (Printing Tabulator, 5 counters, 7 print banks, direct subtraction) - Type 285
6. Electric Accounting Machine (Printing Tabulator, 7 counters. 7 print banks, direct subtraction) - Type 297
7. Electric Accounting Machine (Printing Tabulator, 7 counters, 7 print banks, adding only) - Type 302
8. Alphabetic Accounting Machine - Type 405

2. How are the cards fed into the above machines?

The cards are fed into the machines by means of a knife or knives which slice off one card from the group and feed into the throat, adjusted to allow only one card to pass at a time. The card is then taken by the first set of feed rolls and passed on to the next set going by the brushes which electrically senses the information punched in the card.

3. How many sets of brushes are there in each of the above accounting machines?

1. Vertical Tabulator - One
2. Standard 3 Counter Tabulator - One
3. Standard 5 Counter Tabulator - One
4. Automatic Control Tabulator - Two
5. Electric Accounting Machine Type 285 - Two
6. Electric Accounting Machine Type 297 - Two
7. Electric Accounting Machine Type 302 - Two
8. Alphabetic Accounting Machine Type 405 - Two

4. What is meant by "listing"? "tabulating?"

When the information punched in every card is printed on the report - that is, when there is a printing cycle for every card cycle, the machine is "listing."

When only the group totals of a number of cards are printed - that is, when there is a printing cycle only for every group, the machine is "tabulating."

5. What is the "listing" and "tabulating" speed of all the above accounting machines?

Machine	Listing Cards per Min.	Tabulating Cards per Min.
1. Vertical Tabulator	None	90
2. Standard 3 Counter Tabulator	None	150
3. Standard 5 Counter Tabulator	None	150
4. Automatic Control Tabulator	None	150
5. Electric Accounting Machine Type 285	75	75
" " " " "	75	150
" " " " "	120	120
" " " " "	120	150
6. Electric Accounting Machine - Type 297	100	150
7. Electric Accounting Machine - Type 302	75	150
8. Alphabetic Accounting Machine - Type 405	80	80
" " " " "	80	150

6. What is the counter capacity of each of the above machines and what is the digit capacity of the counter?

Machine	Type No.	No. of Counters	Capacity of Adding Positions	Counters Accumulating Positions
Vertical Tabulator	91	3	8	1
Standard 3 Counter Tabulator	90	3	8	1
Standard 5 Counter Tabulator	92	5	8	1
Automatic Control Tabulator	93	5	8	1
Electric Accounting Machine	285	5	8	1
" " "	285	5 Balance Counters	9	0
" " "	297	7	10	0
" " "	302	6	(2) 9	0
" " "	302	6	(4)10	0
Alphabetic Accounting Machine	405	56	(4) 2	0
			(4) 4	0
			(4) 6	0
			(1) 8	0
Alphabetic Accounting Machine	405	80	(4) 2	0
			(4) 4	0
			(4) 6	0
			(4) 8	0

7. How many print banks are there on each of the printing tabulators and how many type bars in each bank?

Type 285 machines may be obtained with 3, 4, 5, 6, or 7 print banks, but all are basically wired for 7 print banks. Banks #1 and #2 are list banks; banks #3 and #4 are counter banks; banks #5 to #7, inclusive, may be either counter or list banks. Bank #3 has 11 type bars; banks #1, #2, and #3 are 10 position list; all other banks are 9 position list.

Type 297 machines may be obtained with from 3 to 7 print banks. The 7 bank machine is standard. Bank #1 is a list bank and banks #2 to #7, inclusive, are counter banks with 11 type bars with 10 position list. Symbol Printing Control provides an asterisk (*) and a credit symbol (CR) in #1 bar and an asterisk in #11 bar of all print banks.

Type 302 machines may be obtained with from 3 to 7 print banks; 7 banks are standard. The #1 bank is a list bank with 10 position list; #2 and #3 banks are counter banks with 9 position list and total print with asterisk bars; #4 to #7 banks are counter banks with 10 position list and total print with no asterisks.

Type 405 machines are all equipped with 43 alphabetic-numerical type bars for listing alphabetic or numerical data and for total printing numerical data in one bank. The second bank consists of 45 numerical type bars for listing and total printing numerical data. Numerical type bars have an asterisk (*) on odd-numbered bars and a credit symbol (CR) on even-numbered bars. All type bars have individual zero split levers. Zeros print only under control of zero-split levers. Manual and automatic hammerlock control is standard equipment.

8. What is the standard carriage on all printing tabulators?

All printing tabulators are equipped with a carriage having a 20" platen, single and double spacing, with six spaces to the inch.

9. On what machines is the automatic plugboard standard? On what machines is the regular plugboard standard?

6. What is the counter capacity of each of the above machines and what is the digit capacity of the counter?

Machine	No.	Type of Counters	No. of Adding Positions	Capacity of Accumulating Positions	Counters
Vertical Tabulator	91	3		8	1
Standard 3 Counter Tabulator	90	3		8	1
Standard 5 Counter Tabulator	92	5		8	1
Automatic Control Tabulator	93	5		8	1
Electric Accounting Machine	285	5		8	1
" " "	285	5	Balance Counters	9	0
" " "	297	7		10	0
" " "	302	6	(2)	9	0
" " "	302	6	(4)	10	0
Alphabetic Accounting Machine	405	5	(4)	8	0
			(4)	4	0
			(4)	6	0
			(1)	8	0
Alphabetic Accounting Machine	405	80	(4)	8	0
			(4)	4	0
			(4)	6	0
			(4)	8	0

7. How many print banks are there on each of the printing tabulators and how many type bars in each bank?

Type 285 machines may be obtained with 5, 4, 5, 6, or 7 print banks, but all are basically wired for 7 print banks. Banks #1 and #2 are flat banks; banks #3 and #4 are counter banks; banks #5 to #7, inclusive, may be either counter or flat banks. Bank #5 has 11 type bars; banks #1, #2, and #3 are 10 position flat; all other banks are 9 position flat.

Type 297 machines may be obtained with from 3 to 7 print banks. The 7 bank machine is standard. Bank #1 is a flat bank and banks #2 to #7, inclusive, are counter banks with 11 type bars with 10 position flat. Symbol Printing Control provides an asterisk (*) and a credit symbol (CR) in #1 bar and an asterisk in #11 bar of all print banks.

Type 302 machines may be obtained with from 3 to 7 print banks; 7 banks are standard. The #1 bank is a flat bank with 10 position flat; #2 and #3 banks are counter banks with 9 position flat and total print with asterisk bars; #4 to #7 banks are counter banks with 10 position flat and total print with no asterisks.

Type 405 machines are all equipped with #3 alphabetic-numerical type bars for listing alphabetic or numerical data and for total printing numerical data in one bank. The second bank consists of #3 numerical type bars for listing and total printing numerical data. Numerical type bars have an asterisk (*) on odd-numbered bars and a credit symbol (CR) on even-numbered bars. All type bars have individual zero-split levers. Zeros print only under control of zero-split levers. Manual and automatic hammerlock control is standard equipment.

8. What is the standard carriage on all printing tabulators?

All printing tabulators are equipped with a carriage having a 20" platen, single and double spacing, with six spaces to the inch.

9. On what machines is the automatic plugboard standard? On what machines is the regular plugboard standard?

The automatic plugboard is standard on the Electric Accounting Machines, Types 285, 297, 302, and 405.

The regular or non-removable plugboard is standard on the Vertical Tabulator, Type 91, Standard Tabulators Type 90, Automatic Control Tabulator Type 93.

10. What is meant by automatic control?

The automatic control feature is a device which operates so as to stop the feeding of cards at the end of the group being controlled. The operator may then print or transcribe the totals for the group on the report and clear the counters before starting on the next group. Automatic control does not imply automatic resetting or automatic starting of the machine.

11. What machines are equipped with automatic control?

(a) Automatic Control Tabulator, Type 93
(b) Electric Accounting Machine, Types 285, 297, 302
(c) Alphabet Accounting Machine, Type 405

12. What is used to stop those machines not equipped with automatic control?

A specially cut card, known as a stop card, is used to stop the machine after every group. These cards are inserted by hand or, if punched with the group number, sorted into place after every group.

13. What are the chief advantages of the automatic control feature?

The automatic control feature eliminates the use of stop cards. It also verifies the accuracy of the classification of cards by the sorting machine.

14. What is meant by minor control?

Minor control is the term applied to the sub-classifications for which totals are desired.

15. What is meant by intermediate control?

Intermediate control is the term applied to those classifications which contain one or more of the minor groups but which are contained in the major classifications.

16. What is meant by major control?

Major control is the term applied to the main or largest classifications for which totals are desired.

17. How many positions of automatic control are standard:

Automatic Control Tabulator Type 93 - 8 positions, Major and Minor
Electric Accounting Machine Type 285 - 6 or 16 positions, Major and Minor
Electric Accounting Machine Type 297 - 16 positions, Major, Intermediate and Minor
Electric Accounting Machine Type 302 - 16 positions, Major, Intermediate and Minor
Alphabetic Accounting Machine, Type 405 - 20 positions, for both alphabetic and numerical data, Major, Intermediate and Minor
Additional control positions may be ordered if desired.

FEB 20 1936
Acct. No.
Appro.
Dept. MR.
No. Cpd.
Drawing No.
No. Finished
Date Received
Date Promised
Date Finished
Inspector

DUPLICATE

18. What is the difference between adding and group indicating?

Group indication is the addition of only the first card of a group. Adding is the addition of all of the cards in the group for a total of the group.

19. Which fields in the card would normally be group indicated and which would be added?

Fields to be group indicated: Salesman --- Commodity --- District or Branch
Job No. --- Unit Price -- Man No.
Fields to be added: --- --- - Quantity --- Hours --- Pieces --- Amounts

20. How many positions of group indication are standard?

Machine	Positions of Group Indication
Vertical Tabulator - Type 91	First 4 positions, or 1 counter
Standard Tabulator - Type 90	1 counter, 3 if desired
Standard Tabulator - Type 92	1 counter, 3 if desired
Automatic Control Tabulator - Type 93	1 counter, 3 if desired
Electric Accounting Machine - Type 285	10 or 20 positions
Electric Accounting Machine - Type 297	20 positions
Electric Accounting Machine - Type 302	20 positions
Alphabetic Accounting Machine - Type 405	All positions by counter control, class selection, or hammer lock control.

Additional group indicating capacity may be obtained for all machines if desired.

21. What is meant by manual clearing or reset of the counters? Automatic reset?

The counters on the Types 90, 91, 92, and 93 Standard and Automatic Control Tabulators are cleared by the accumulating collars which are engaged by hand.

The counters on the Types 285, 297, and 302 are cleared magnetically, the accumulating collar being engaged automatically at the end of the group, and the total printed.

22. How is the magnetic clearing device controlled?

The magnetic clearing device is controlled by the counter dial switches. There are five switch positions which control the counter in the following manner:

Position	Function
Off	Magnetic clearing device non-operative - TOTAL NOT PRINTED.
Total - Non Reset	Magnetic clearing device non-operative - Progressive total printed.
Minor	Magnetic clearing device operative after minor group change - minor total in counter printed and counter reset.
Intermediate	Magnetic clearing device operative after intermediate group change - intermediate total in counter printed and counter reset.
Major -	Magnetic clearing device operative after major group change - major total in counter printed and counter reset.

18. What is the difference between adding and group indicating?

Group indication is the addition of only the first card of a group. Adding is the addition of all of the cards in the group for a total of the group.

19. Which fields in the card would normally be group indicated and which would be added?

Fields to be group indicated: Salesman --- Commodity --- District or Branch No. --- Unit Price --- Man No.

Fields to be added: --- --- --- Quantity --- Hours --- Pieces --- Amounts

20. How many positions of group indication are standard?

Machine	Positions of Group Indication
Vertical Tabulator - Type 91	Print 4 positions, or 1 counter
Standard Tabulator - Type 90	1 counter, 3 if desired
Standard Tabulator - Type 92	1 counter, 3 if desired
Automatic Control Tabulator - Type 93	1 counter, 3 if desired
Electric Accounting Machine - Type 285	10 or 20 positions
Electric Accounting Machine - Type 297	20 positions
Electric Accounting Machine - Type 302	20 positions
Alphabetic Accounting Machine - Type 405	All positions by counter control, class selection, or hammer lock control.

Additional group indicating capacity may be obtained for all machines if desired.

21. What is meant by manual clearing or reset of the counters? Automatic reset?

The counters on the Types 90, 91, 92, and 93 Standard and Automatic Control Tabulators are cleared by the accumulating collars which are engaged by hand.

The counters on the Types 285, 297, and 302 are cleared magnetically, the accumulating collar being engaged automatically at the end of the group, and the total printed.

22. How is the magnetic clearing device controlled?

The magnetic clearing device is controlled by the counter dial switches. There are five switch positions which control the counter in the following manner:

Position	Function
OFF	Magnetic clearing device non-operative - TOTAL NOT PRINTED.
Total - Nln Reset	Magnetic clearing device non-operative - Progressive total printed.
Minor	Magnetic clearing device operative after minor group change - minor total in counter printed and counter reset.
Intermediate	Magnetic clearing device operative after intermediate group change - intermediate total in counter printed and counter reset.
Major -	Magnetic clearing device operative after major group change - major total in counter printed and counter reset.

23. What is the purpose of the asterisk?

The printing of the asterisk (*) indicates the figure printed is a total.

24. What is the purpose of the class selection device?

1. To select the counter in which information is to appear.
2. To select one or two amounts appearing on a card.
3. To eliminate certain classes of information.

The class selection device is controlled by an "X" punched in the card, and the control impulse is read through the upper or control brushes.

25. (a) How many positions of class selection are standard? (b) Can additional capacity be obtained?

(a)

Machine	Units	Positions
Vertical Tabulator - Type 91	None	
Standard Tabulator - Type 90	None	
Standard Tabulator - Type 92	None	
Automatic Control Tabulator - Type 93	None	
Electric Accounting Machines - Type 285	1	10
Electric Accounting Machines - Type 297	1	10
Electric Accounting Machines - Type 302	3	10
Alphabetic Accounting Machines - Type 405	4	10

(b) Additional class selector capacity can be obtained if desired.

26. What is the function of the X-distributor?

The function of the X-distributor is to provide "X" impulses to control the subtraction counters for either the adding or subtracting. There are five pairs of these hubs designated: X1, X2, X3, X4, and X5. These hubs are plugged to the control brushes in the positions corresponding to the card columns in which the X's will be punched.

The X-distributor is in effect a counter class selector for adding, subtracting, and eliminating cards in a manner similar to that of a class selector.

27. Which machines are equipped with the X-distributor?

The Electric Accounting Machines Types 285, 297, and 405 are equipped with one individual type X-distributor unit. This unit consists of 5 individual smaller units of 3 positions, No X, X, and Common. The individual X-distributor differs from the progressive X-distributor only in connection. Any individual X-distributor may be made into a progressive X-distributor by properly connecting the plugboard.

28. Can additional X-distributor units be obtained?

Additional X-distributor units can be obtained, if desired.

29. What is the difference between direct subtraction and complement subtraction?

Direct subtraction is accomplished by the machine through the energization of the subtraction magnets. The figure punched in the card is the true figure, and the subtraction is controlled by the X-distributor impulse.

Complement subtraction is obtained by punching the complement of the figure instead of the true figure in the card. For example, if it were necessary to sub-

tract an amount 18 from a total in the counter, the card would be punched 99982 (five column field) and the impulses read into the adding magnets. Adding the complement will accomplish the same result as subtracting the true figure.

Actually, both the direct subtraction counter method and the complement card method depend on complements, but in the case of the former the complement is obtained in the counter instead of being punched in the card.

30. What is meant by single balance counter? Double balance counter?

In a single balance counter the balance is kept in only one counter. If the final result is a complement, the total is printed as a true figure with a symbol (-) or (CR) to indicate the minus amount.

In a double balance counter, two balances are kept, one being A-B and the other B-A. The two counters containing both the true and complement totals are engaged at the end of the group and cleared, but only the true total is printed.

31. What is the complement of a figure and how is it obtained?

The complement of a figure is the difference between the number and infinity.

Find the complement of the following:

Number	Calculation	Complement
156	999 - 156 = 843 843 + 1 = 844	99999844
5007	9999 - 5007 = 4992 4992 + 1 = 4993	99994993
7128	9999 - 7128 = 2871 2871 + 1 = 2872	99992872
19900	99999 - 19900 = 80099 80099 + 1 = 80100	99980100

The "1" is known as the elusive one.

32. What is the purpose of the Stacker Stop?

The Stacker Stop is a device attached to the stacker to stop the machine after the stacker is filled.

33. What machines are equipped with a Stacker Stop?

Electric Accounting Machines Types 285, 297, 302, and 405. Any machine can be equipped with a stacker stop, if desired.

34. What is meant by single and successive reset?

On a group change of both Minor and Major classification if only the Minor total is cleared and printed on the first reset and a second reset is necessary to clear the Major total, the machine is a successive reset machine.

If both totals are printed on the first reset, the machine is a single reset machine.

The purpose of the successive reset is to print the Major total on the line below the Minor total. In the case of the single reset machine, the Minor and

major totals are printed on the same line.

The single and successive reset device is controlled by a switch on the front of the machine.

35. What machines are equipped with the single and successive reset feature?

Electric Accounting Machine Types 285, 297, and 302.
Alphabetic Accounting Machine Type 405.

36. What are the current requirements of all the machines?

Machine	Type No.	Current Requirements
Vertical Tabulator	91	110-220 volts D.C. or A.C.
Standard Tabulator	90	110-220 volts D.C.
Standard Tabulator	92	110-220 volts D.C.
Automatic Control Tabulator	93	110-220 volts D.C.
Electric Accounting Machine	285	110-220 volts D.C.
" " "	297	110-220 volts D.C.
" " "	302	110-220 volts D.C.
Alphabetic Accounting Machine	405	110-220 volts D.C. or A.C.

37. What is the current consumption for each of the above machines?

Machine	Type No.	Current Consumption			
		Start		Run	
		110 D.C.	110 A.C.	110 D.C.	110A.C.
Vertical Tabulator	91	12.8	23.0	2.7	5.0
Standard Tabulator	90	5.8	-	1.0	-
Standard Tabulator	92	7.0	-	1.3	-
Automatic Control Tabulator	93	7.0	-	1.5	-
Electric Accounting Machine	285	7.5	-	3.7	-
" " "	297	10.8	-	4.4	-
" " "	302	10.8	-	4.4	-
Alphabetic Accounting Machine	405	17.0	30.0	4.0	9.0

The current values for 220 volts D.C. or A.C. are slightly greater than one-half of the values given in the table for 110 volts.

38. What is the approximate weight of the tabulating machines?

Machine	Type No.	Weight
Vertical Tabulator	91	455 lbs.
Standard Tabulator	90	395 lbs.
Standard Tabulator	92	514 lbs.
Automatic Control Tabulator	93	585 lbs.
Electric Accounting Machine	285	1141 lbs.
" " "	297	1690 lbs.
" " "	302	1560 lbs.
Alphabetic Accounting Machine	405	1779 lbs.

39. What is the function of the Quick Insert or Line Finding Device?

The purpose of the Quick Insert device is to enable the operator to insert a printed form to the proper line for printing the first total or listing the first card. This device is particularly useful where there is a printed heading at the top of the report sheet.

major totals are printed on the same line.

The single cmd successive reset device is controlled by a switch on the front of the machine.

35. What machines are equipped with the single cmd successive reset feature?

Electric Accounting Machine Type 285, 297, and 302.
Alphabetic Accounting Machine Type 405.

36. What are the current requirements of all the machines?

Machine	Type No.	Current Requirements
Vertical Tabulator	91	110-220 volts D.C. or A.C.
Standard Tabulator	90	110-220 volts D.C.
Standard Tabulator	92	110-220 volts D.C.
Automatic Control Tabulator	93	110-220 volts D.C.
Electric Accounting Machine	285	110-220 volts D.C.
" " "	297	110-220 volts D.C.
" " "	302	110-220 volts D.C.
Alphabetic Accounting Machine	405	110-220 volts D.C. or A.C.

37. What is the current consumption for each of the above machines?

Machine	Type No.	Current Consumption Start	Current Consumption Run
		110 D.C.-110 A.C.	110 D.C.-110 A.C.
Vertical Tabulator	91	12.8	2.7
Standard Tabulator	90	5.8	1.0
Standard Tabulator	92	7.0	1.5
Automatic Control Tabulator	93	7.0	1.5
Electric Accounting Machine	285	1.5	3.7
" " "	297	10.8	4.4
" " "	302	10.8	4.4
Alphabetic Accounting Machine	405	17.0	4.0

The current values for 220 volts D.C. or A.C. are slightly greater than one-half of the values given in the table for 110 volts.

38. What is the approximate weight of the tabulating machines?

Machine	Type No.	Weight
Vertical Tabulator	91	455 lbs.
Standard Tabulator	90	395 lbs.
Standard Tabulator	92	514 lbs.
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Electric Accounting Machine	285	1141 lbs.
" " "	297	1690 lbs.
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39. What is the function of the Quick Insert or Line Finding Device?

The purpose of the Quick Insert device is to enable the operator to insert a printed form to the proper line for printing the first total or listing the first card. This device is particularly useful where there is a printed heading at the top of the report sheet.

40. What is the function of the Summary Punch?

The Summary Punch does what its name indicates; that is, punches cards which are summaries of those that have gone through the tabulator. At the end of a group the totals for the group are in the counters, and where a less detailed report is going to be necessary later in the month or year, one card is punched to represent the group. By means of a Summary Punch the totals are automatically transcribed from the counters to a punched summary card, besides being printed on the report.

41. What machines can be equipped with a Summary Punch?

Electric Accounting Machines Types 285, 297, and 302.

42. What is the purpose of the Card Count Hub?

The Card Count Hub is used to count the number of cards passing through the machine. When plugged to any counter the device will count the number of cards passing through the feed. The total in the counter may be either printed on a report or summary punched, or both.

43. What machines are equipped with the Card Counting Hub?

All tabulators and electric accounting machines have a Card Count Hub.

44. What fractional wheels can be furnished in addition to the standard one-tenth wheels?

All machines may be equipped, if desired, with 1/2, 1/3, 1/4, 1/5, 1/6, 1/8, and 1/9 wheels.

SPECIAL DEVICES

45. What is the Bill Feed Device?

The Bill Feed Head is a special carriage and form feeding mechanism which may be attached to the Type 285, 297, or 302 and 405 machines to automatically feed and eject single page forms, such as gas and electric bills.

46. What is a Continuous Form Feed Device?

The Continuous Form Feed Device is a paper guide and line finding attachment for feeding continuous manifold sheets.

47. What is the Automatic Major Control Stop?

Numerical machines with magnetic clearing devices ordinarily continue in operation after a major control change. An Automatic Stop can be provided to cause the machine to stop either before or after taking a major control total, or both. (A similar stop can be provided for intermediate control on Type 297 and Type 285 machines, which are so equipped.)

The Type 405 Alphabetic Accounting Machine can be provided with an Automatic Major Control Stop to cause the machine to stop after taking a major control total. (A stop can also be provided for intermediate control.) An automatic stop before taking totals is standard equipment on this machine.

The stop before taking totals is necessary when it is desired to shift the carriage for printing the total. The stop after taking the total is useful when it is desired to change sheets for major control groups.

48. What is the Auxiliary Card Counter?

All tabulating and accounting machines can be equipped with one or two Veeder Counters for the following purposes:

1. To count all cards passing through the machine by plugging directly from the card count hub to the TCC hub on the plugboard.
2. To count the number of cards in different classifications by plugging the card counter impulse through a class selector to the TCC hub.
3. To count the number of minor control groups by plugging the card count impulse through the group indicator to the TCC hub.

The Veeder Counter has six positions allowing for a total count of 999,999.

49. What is the Card Feed Stop?

The Automatic Card Feed Stop may be installed on accounting machines to prevent the machine from running out of cards and printing a total before the end of a control group. This device functions when about five cards remain in the hopper, thus permitting the operator to supply more cards.

50. What is the Complement Total Suppression Device (for use only on adding counters)?

The complement total suppression device is used to suppress the printing of complement totals from adding counters. It is permanently attached to one or more adding counters and controls the printing of totals in the respective print banks. When a "9" appears in the last magnet controlled adding wheel to the left in the counter, the counter is cleared but the printing of the total is suppressed.

One adding position must be reserved for the exclusive use of determining whether or not the total is to be printed. For this reason, the nine magnet counter must be used to obtain an eight digit balance. A switch is provided to restore the counter to normal capacity and operation for other work.

This device may be installed on the Type 289 and Type 297 Electric Accounting Machines.

51. What is the Consecutive Number Control Device?

The Consecutive Number Control Device causes the Electric Accounting Machine to indicate those numbers which are missing from a consecutive list by printing a symbol opposite the first line after the break in sequence. This is shown in the following illustration where the "M" indicates that the numbers 4532, 4538, 4539, 4540 are missing.

4530	
4531	"M" indicates
4533M	that one or
4534	more numbers
4535	are missing
4536	
4537	
4541M	
4542	

This device operates on only one card column at a time and for this reason will not indicate a break in the sequence of any other column. Thus, if exactly 10, 20, 30, 100, etc., cards are missing, there will be no "M" indicated. A column used for this purpose cannot be used simultaneously for automatic control.

The missing number indication is usually printed from the asterisk bar, the symbol being placed in the "1" position. Thus, the missing number symbol does not interfere with either the asterisk or the credit symbol printing. If necessary, any type bar may be used, indicating the regular "1" or any special symbol desired. The substitution of a character for the "1" requires

a permanent type bar change.

The Consecutive Number Control Device may be installed on all printing tabulators and hubs for plugging this device are provided on the standard automatic plugboard.

52. What is the purpose of Demountable Type Bars?

Demountable Type Bars provide a means for obtaining flexibility in the printing of symbols and special characters without permanently changing the type on those bars so arranged. The bars are designed so that clips of type can be placed in the bars by the operator quickly and easily.

The Demountable Type Bars consist of two separate units - a special bar split to hold casings of type, and the casing or clip of type to be inserted in the bar. A clip of type consists of ten characters of type which are fixed within a casing and cannot be removed or changed. However, the type within a casing may be of any specified characters or symbols, in any arrangement desired.

The type is changed by pressing a latch at the top of the bar and spreading the bar to allow the clip of type to be removed and replaced by another clip. The type is then locked solidly in place by releasing the latch.

One clip of type is included with each demountable bar assembly. Many special reports can be printed through the use of specially arranged clips of type. For example, the type clip in the units or hundreds position in a print bank used to print amounts can be arranged with decimals. Or two adjacent type bars may be arranged with clips of type offset to the right or left to give a space between columns of figures, etc.

Special characters, such as the dash, dollar sign, fractions, or other desired symbols may be specified in the make up of clips.

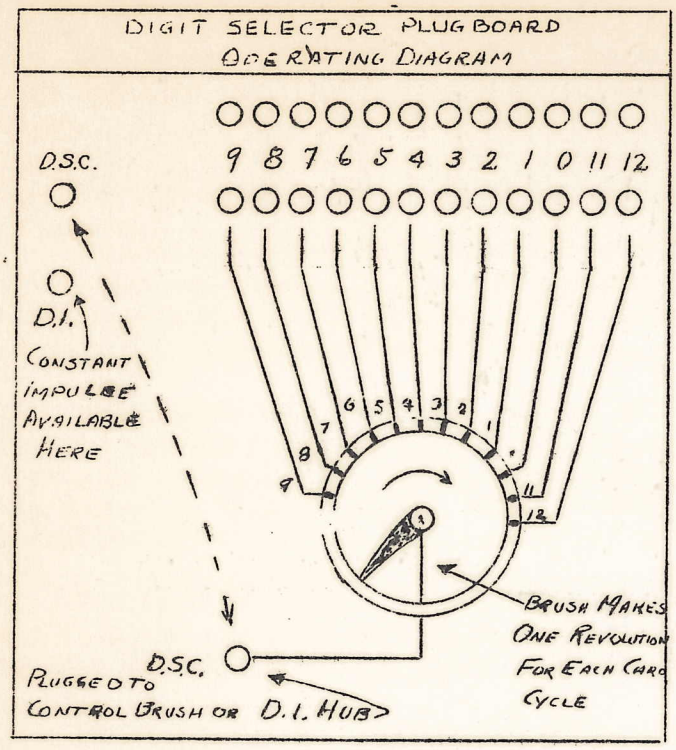
These type bars can be installed to replace any standard type bar in the Type 285, 297, and 302 Electric Accounting Machines.

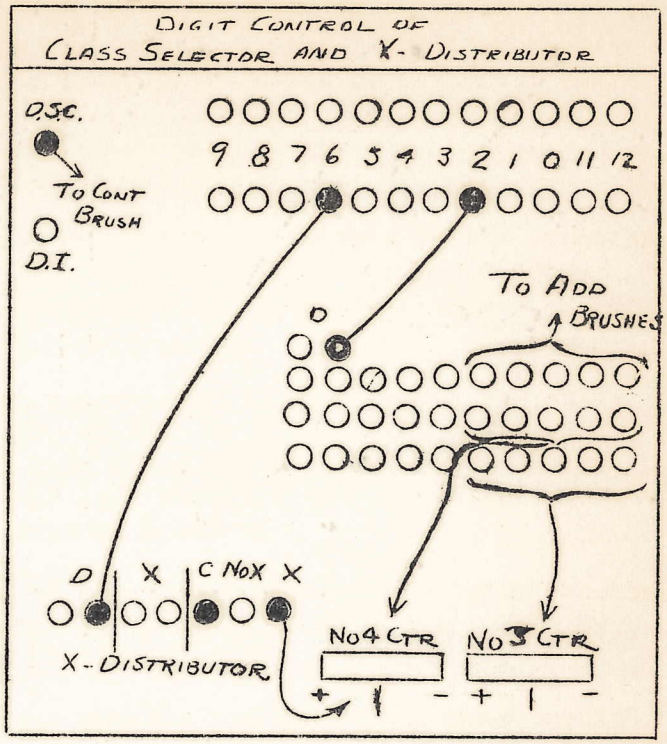
53. What is the function of the Digit Selector?

The Digit Selector is a special device for Electric Accounting Machines by means of which such units as Class Selectors, X-distributors, etc., which are normally X-controlled, may also be controlled by any desired punched digit (or digits) of a card column. With this device, therefore, one column of a card can be used for punching the equivalent of 12 controlling X's.

The device is represented on the plugboard by one D.S.C. (digit selector common) hub and twelve common pairs of "digit" hubs, as shown in figure. Internally, the device consists of an emitter which operates during every card-feeding cycle, and connects each pair of "digit" hubs to the common hub in turn, as the corresponding card positions pass under the brushes. The operating diagram shown below illustrates the manner in which these successive connections are made.

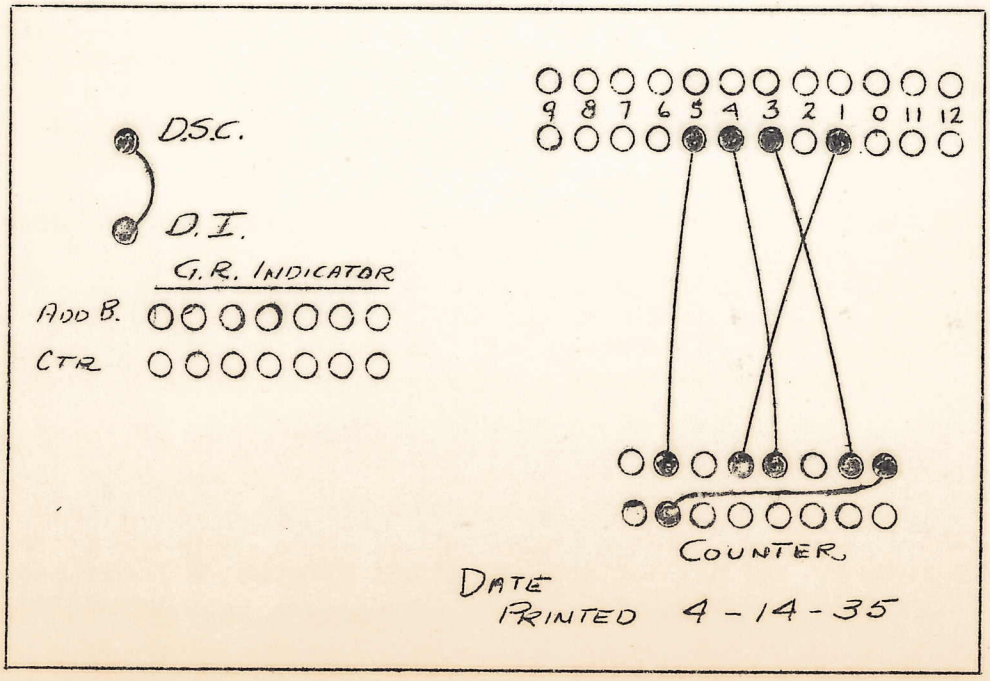
Each Class Selector and X-distributor position is provided with a pair of special pick-up hubs, designated "D" (digit pick-up) which permits control of the units by any digit. These special hubs are in addition to the regular X pick-up hubs which permit X-control only, in the normal manner. A "D.I." (digit impulse) hub is provided also for use with the Digit Selector for the accumulation or listing of constant data.

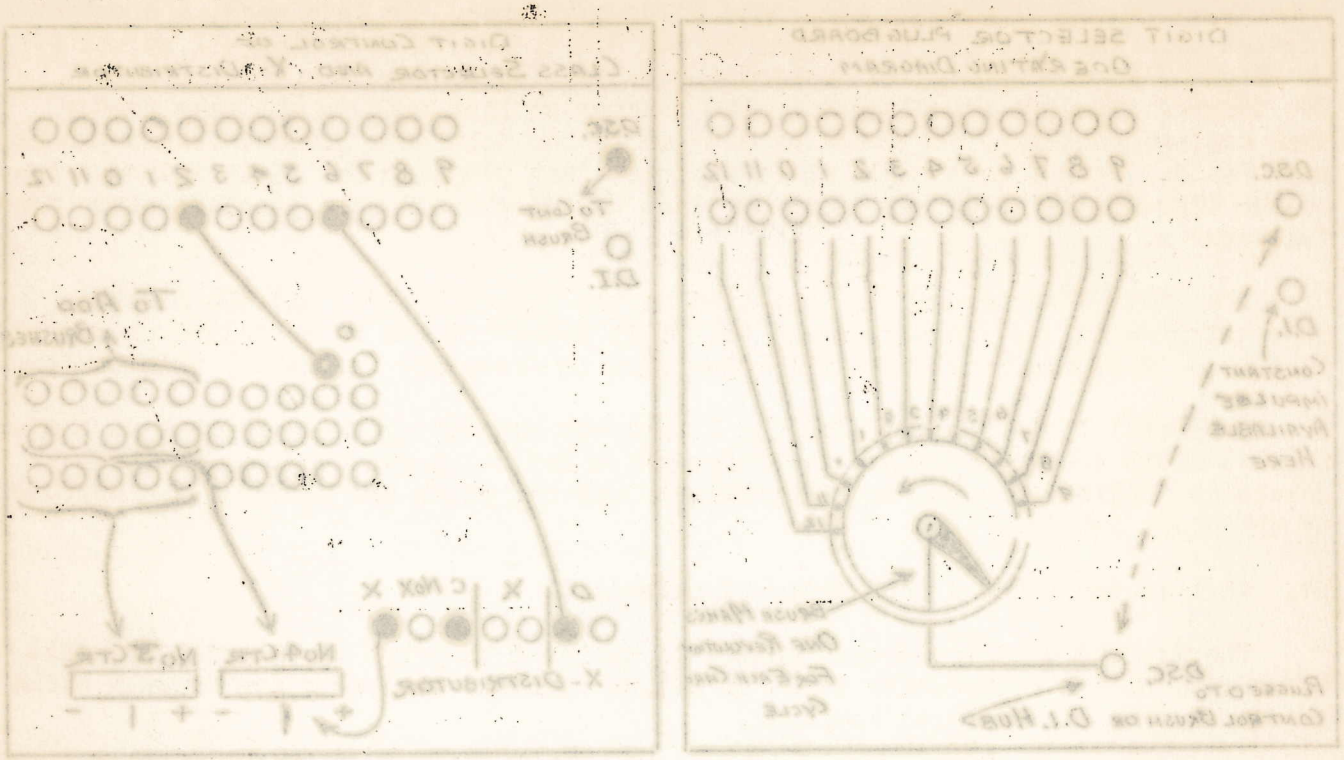

DIGIT SELECTOR PLUG BOARD
OPERATING DIAGRAM
D.S.C.
9 8 7 6 5 4 3 2 1 0 11 12
D.I.
CONSTANT IMPULSE AVAILABLE HERE
BRUSH MAKES ONE REVOLUTION FOR EACH CARD CYCLE
D.S.C.
PLUG TO CONTROL BRUSH OR D.I. HUB



A typical example of the use of a digit selector for controlling a Class Selector and X-distributor is illustrated in the figure above. In this example, cards punched "2" in the controlling card column cause the class selector to be "controlled," thereby directing the adding brush impulse into counter #3. All other cards are directed into counter #4. Counter #4, however, adds only those cards which are punched "6" in the control column, as directed by the X-distributor under control of the digit "6".

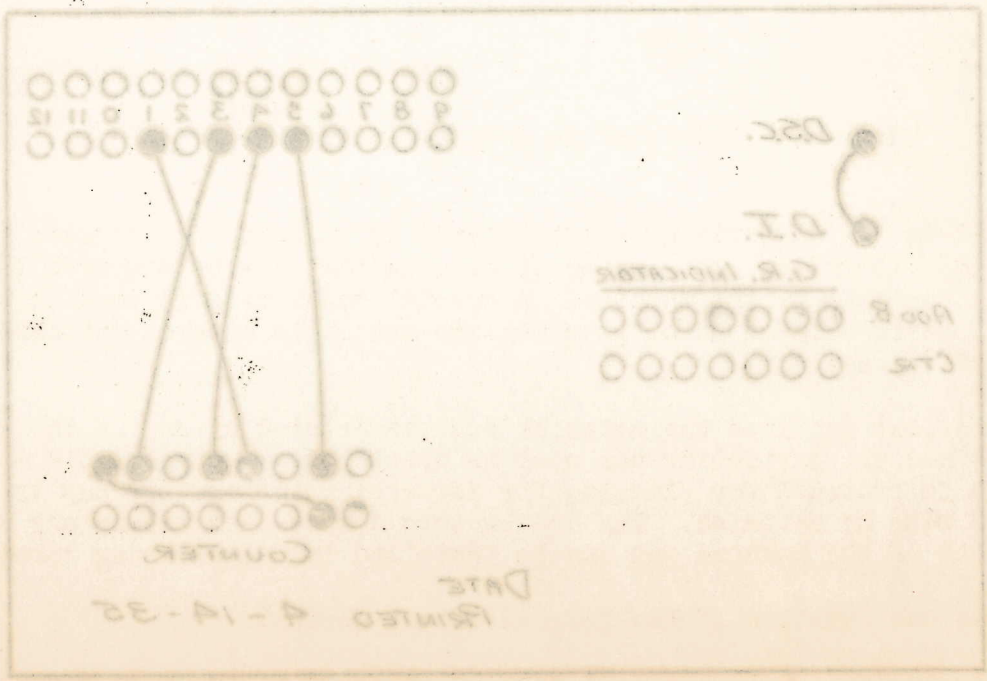
It should be noted that although the digit pick-up impulses are supplied at points other than X in the card cycle (2 and 6 in this example), the units being controlled are not affected until after the X point in the cycle, or, in other words, they operate as though they were X-controlled.





A typical example of the use of a digit selector for controlling a Class Selector and X-distributor is illustrated in the figure above. In this example, cards punched "2" in the controlling card column cause the class selector to be "controlled," thereby directing the adding brush impulse into counter #2. All other cards are directed into counter #4. Counter #4, however, adds only those cards which are punched "6" in the control column, as directed by the X-distributor under control of the digit "6".

It should be noted that although the digit pick-up impulses are supplied at points other than X in the card cycle (2 and 6 in this example), the units being controlled are not affected until after the X point in the cycle, or, in other words, they operate as though they were X-controlled.



The preceding figure illustrates the use of the Digit Selector for printing a date which is not punched in the cards being tabulated. In this case, a constant impulse from the D.I. hub is plugged to the D.S.C. hub, thus making all points of the Digit Selector active and available for plugging to counters or list banks. The desired impulses are plugged to the counter or list bank in the same manner that adding-brush impulses would be plugged if the data were printed from a punched card field. From this example it is apparent that plugging the digit selector impulses through the group indicator or class selector would make possible other useful results.

The Digit Selector may be installed on the Type 285, 297, and 302 Electric Accounting Machines. (A maximum of two Digit Selectors can be installed on any one machine.) A double panel automatic plugboard is necessary to install this device.

A special Digit Selector for the Alphabetic Accounting Machine makes it possible to digit select on alphabetic information and to operate such units as Class Selectors, X-distributors, and Hammer-lock Control, which are normally X-controlled, by the digit impulse.

54. What is the Matched Card Indication Device?

The Matched Card Indication Device is designed to print an asterisk opposite the second of two consecutive cards in a list when the two cards are exactly alike in one or more fields being compared.

For example, when card checks and duplicates are sorted together in check number sequence and listed, it is desirable to indicate when the check numbers and amounts of each two consecutive cards agree, as illustrated below:

Check No.	Check Amount	Duplicate Amount	
4521	2505		Indication - Check Nos. and
4521		2505 *	Amount agree
4522		5107	No indication (check outstanding)
4523	1000		
4523		1000 *	Indication - Check Nos. and Amount agree
4524	6305		
4524		6315	No indication (Amounts do not agree)

Class selected from one card field

The set-up for comparison is established by plugging the regular automatic control unit and, therefore, the number of columns that can be compared is limited to the control capacity of the machine. A special shunt plug is used in place of the regular automatic control shunt plug and the automatic control switches are turned to their "off" position.

On numerical machines the asterisk must be printed by one of the regular asterisk bars and the particular bar must be specified. On alphabetic machines a special hub is provided for plugging for asterisk printing from any type bar which is equipped with an asterisk. The use of this device does not in any way affect the operation of the machine and can be installed in all printing tabulators.

55. What is the function of the Pre-indication Device?

The Pre-indication Device is a special internal wiring arrangement for numerical and alphabetic Electric Accounting Machines which makes possible the listing

of the control number of a group of cards before that group enters the adding brushes for printing. Pre-indication is accomplished by listing the control information from the control (upper) brushes instead of from the adding (lower) brushes. Such an arrangement is particularly advantageous for ledger posting operations and for summary punching operations which involve the changing of master cards according to control group changes.

The following illustration shows two methods for printing pre-indications of control data on the Type 285 and 297 Electric Accounting Machines:

STUB	CUSTOMER NO.	AMOUNT
4565	4565	67535
4565	4565	75633
4577	4565	35264
		178432 *

CUST. NO.	QUANTITY	AMOUNT
4565	7562	67535
4565	8335	75633
4577	3645	35264
		178432 *

STUB	CUSTOMER NO.	AMOUNT
4577	4577	16832
4577	4577	29567
4580	4577	19432
		65831 *

CUST.NO.	QUANTITY	AMOUNT
4577	1078	16832
4577	2756	29567
4580	1362	19432
		65831 *

The report on the left shows the pre-indication on a stub which can be torn off or otherwise disregarded when the documents are used. The report on the right shows the pre-indication printed in the same field as the normal control data. Any list banks or counter banks of numerical machines can be used for listing pre-indications.

Alphabetic machines (only those equipped with alphabetic control) can be arranged to pre-indicate only numerical data from any type bars. The installation of the pre-indication device does not in any way affect the normal operations of the machine since it merely permits listing from the control brushes as well as from the adding brushes.

The Pre-indication Device can be installed on machines having relay type of automatic control.

56. What is the Progressive X-Distributor?

The Progressive X-Distributor is available and may be specified on all subtraction machines in place of the Individual X-Distributor. It is employed particularly when it is necessary to have one X-control punching cancel another or where it is desirable to punch only one control X in each type of card.

The Progressive X-Distributor consists of five class selector units, internally wired in series, the No X position of each selector being connected to the common position of the next selector in the series. The control impulse hubs are wired permanently to the common position of selector #5. The Individual X-Distributor may be wired externally as a Progressive X-Distributor.

The distributor permits the handling of six separate classes of cards in different ways, the cards being designated by NoX, X1, X2, X3, X4, and X5. Because of the fixed wiring of the relays in series, an order of preference is established for cards punched with more than one X, or cards of certain types punched with a different control X for each type. For example, a card X-punched in the column which is wired to X4 of the distributor and also in that wired to X5 will be treated as though it were only punched for X5.

57. What is the function of the Single Card Total Suppression Device?

This device is employed for the purpose of improving the appearance of tabulations in which single card groups are of frequent occurrence. This device eliminates the printing of the total when a single card has registered, thus avoiding the appearance of a double printing of the same item.

The speed of the machine remains unchanged by the addition of this device, since it spaces during the time in which it would ordinarily be printing the total. Asterisks are not printed when the total is suppressed but may be printed opposite any printed total as shown in the illustration.

	Account Number	Amount
NORMAL OPERATION	1	4500
		4500*
SWITCH "OFF"		
	2	300
	2	700
		1000*
	3	400
		400*
SINGLE CARD TOTALS	1	4500
SUPPRESSED	2	300
	2	700
SWITCH "ON"		1000*
	3	400

This device may be installed on any of the printing tabulators.

58. What is the function of the Split Column Device?

It is sometimes necessary to use two parts of a single card column for different purposes. In this event, accounting machines can be arranged to operate as though the punching were in separate columns of the card. For example, the year can be punched in the same column with the first digit of the month, and both can be indicated separately, as illustrated.

The illustration shows the punching arrangement of a column split between positions 1 and 2 and the method of plugging the column split device.

The machine operates in the same way when using the device as it would if entirely separate columns were used. The functions of listing, indicating, adding and controlling are not affected by the fact that two or more holes are punched in the same column. Only one device may be installed on a machine; however, it may be plugged to any one column to accomplish a split between any two specified positions of a card from "0" to "9".

The principal use of split columns arises from lack of columnar space to record necessary information, since it is obviously not desirable to punch two holes in a single column when other columns are available.

This device may be installed on all accounting machines.

57. What is the function of the Single Card Total Suppression Device?

This device is employed for the purpose of improving the appearance of tabulations in which single card groups are of frequent occurrence. This device eliminates the printing of the total when a single card has registered, thus avoiding the appearance of a double printing of the same item.

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	Account Number	Amount
NORMAL OPERATION	1	$500
		$500*
SWITCH "PPT"		
	2	300
	2	700
		1000*
	3	$ 00
		00*
SINGLE CARD TOTALS	1	$500
SUPPRESSED	2	300
	2	700
SWITCH "CN"		1000*
	3	00

This device may be installed on any of the printing tabulators.

58. What is the function of the Split Column Device?

It is sometimes necessary to use two parts of a single card column for different purposes. In this event, accounting machines can be arranged to operate as though the punching were in separate columns of the card. For example, the year can be punched in the same column with the first digit of the month, and both can be indicated separately, as illustrated.

The illustration shows the punching arrangement of a column split between positions 1 and 2 and the method of plugging the column split device.

The machine operates in the same way when using the device as it would if entirely separate columns were used. The functions of listing, indicating, adding and controlling are not affected by the fact that two or more holes are punched in the same column. Only one device may be installed on a machine; however, it may be plugged to any one column to accomplish a split between any two specified positions of a card from "0" to "9".

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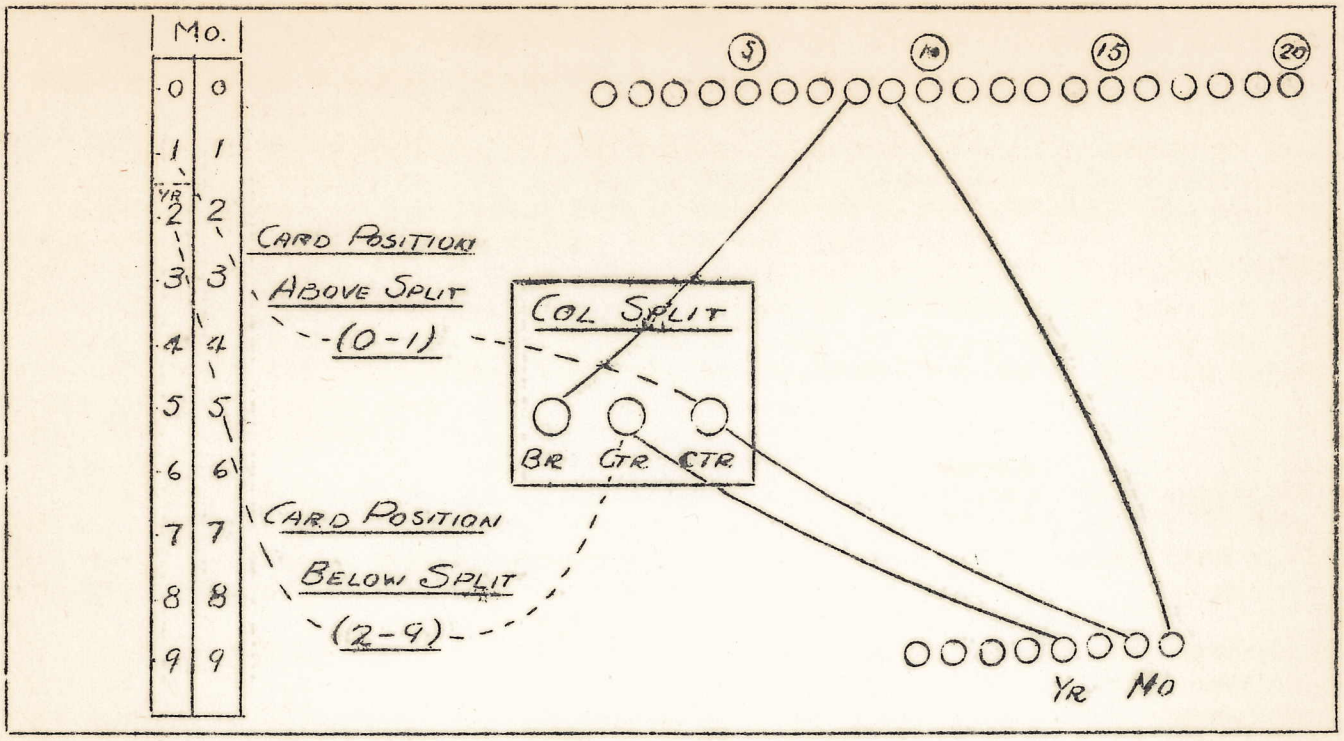
This device may be installed on all accounting machines.



59. What are split counters and split print banks?

Where an adding counter is used for the purpose of obtaining totals of two or more fields, it is sometimes desirable to arrange it so that the total from one part of the counter will not carry over into the other part. This arrangement can be made permanent by installing a special carry-lever between the two parts of the counter.

However, if the counter is also to be used for other work, where the counter as a whole is required, a carry-lever lockout can be employed as a means of either preventing or allowing a carry over as desired. This device may be permanently installed between any two positions of a counter.

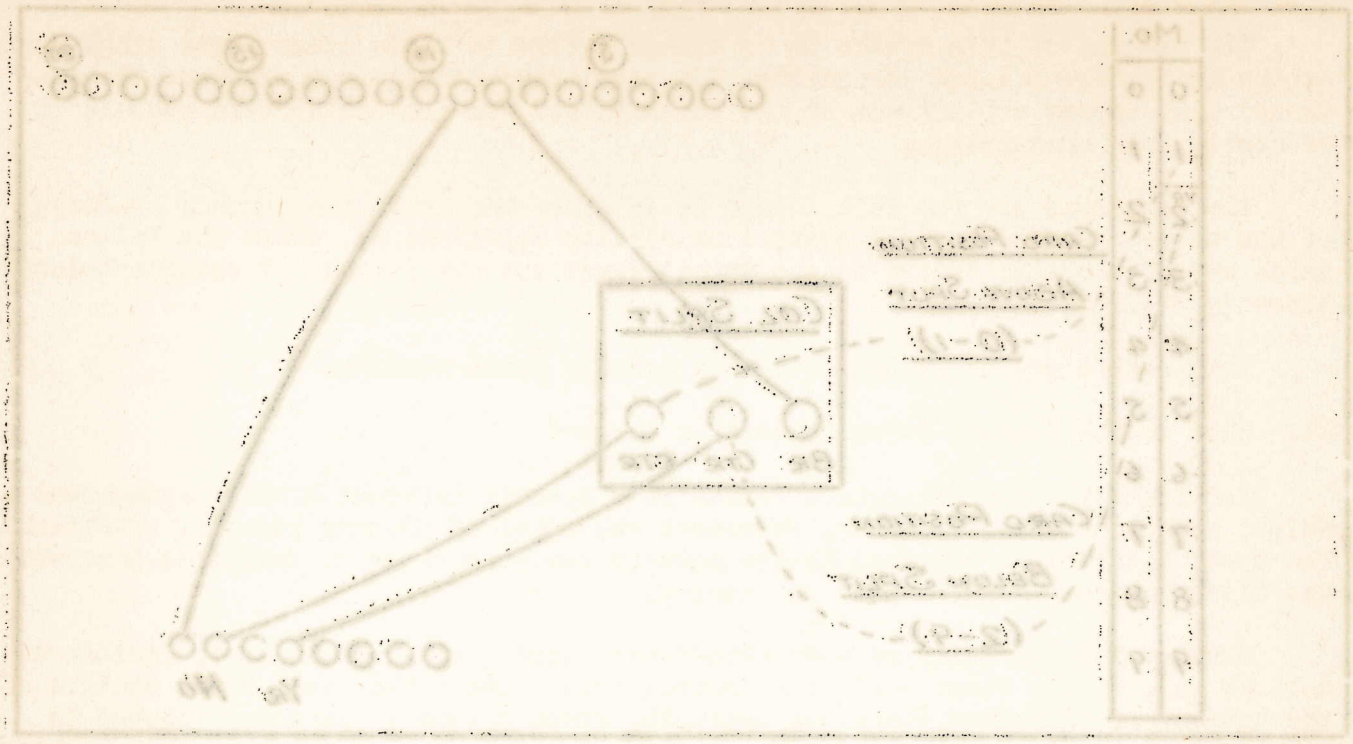
The use of the special carry lever or the carry lever lockout device does not affect the operation of the print bank, which will normally print zeros between the totals. Zeros between totals can be prevented from printing by making a permanent split between type bars by removing the zero pawl. This will affect the operation of the print bank for use as a single unit, in cases where a carry-lever lockout is used, since zeros will not be printed automatically to the right of the bar from which the zero pawl has been removed.

60. What is the purpose of the Summary Punch Elimination Device for suppression of summary punching on single card groups?

This device controls the Type 516 Automatic Summary Punch in such a manner that is will punch a summary card for each detail card group that consists of two or more cards, but will not operate when the detail card group consists of a single card.

When no summary card is punched, the single detail card is itself offset in the accounting machine card stacker so that it can be readily removed and used as the summary card.

A switch controls the operation of this device in such a way that either normal summary punching or elimination summary punching can be obtained at will.



The purpose of this device is to conserve time in those cases where single card groups constitute a large percentage of a tabulating machine run or where the continued unnecessary replacement of one summary card for one detail card results in excessive card consumption.

The principal use for this device is in connection with the summary punching of new balance cards in stock control or similar applications, where the balance cards are of the same design as the detail cards and are capable of being tabulated directly with them.

This device can be installed on any summary punch machine.

61. What is the Summary Punch Indication Device?

The Summary Punch Indication Device is a special internal wiring arrangement which, under certain conditions, increases the speed of summary punching operations. The speed increase is obtained by the summary punching of group indicated data while the Electric Accounting Machine is running.

Summary Punches equipped with this device start punching the group indicated data as soon as the first card of a control group passes the lower brush station of the tabulator. Punching continues until the first column to be total punched is reached. At this point (provided the control has not already changed) the punching ceases until a control change occurs, at which time it proceeds as usual.

In order to warrant the installation of this device, it is necessary to compute whether or not there will be any time saved through its use under specific conditions. This computation consists of determining the average net time available for the punching of group indicated data before a control change stops the accounting machine. Briefly, the procedure is as follows: (Computations based on a tabulator speed of 150 cards per minute and a punching speed of 10 columns per second.)

Determine the average number of cards per control group (X). Multiply this figure, minus one, by the time required for one card cycle (.4 second). The resulting figure is the average gross time available for punching before each control change.

If information is also to be duplicated from a master card, the time required for this must be deducted from the gross available time in order to arrive at the net available punching time. To determine the time required for duplicating, multiply the number of columns to be duplicated (Y) by the time required to punch one column (.1 second).

Expressing the foregoing computations mathematically, the formula is:

$$.4\,(X-1) - .1Y = \text{Seconds available for G. I.}$$

Punching at each control change.

If this equation results in a zero or a minus figure, the Summary Punch Indication Device will be of no benefit. If the equation results in an appreciable plus figure, multiplying this figure by the total number of control changes gives the total time which can be saved.

62. What is the Test Scoring Device?

This device is an attachment for the Electric Accounting Machine which provides a rapid, semi-automatic means of grading tests of educational, vocational, and psychological nature. The operation of this device can best be understood by a description of an application for which it is well adapted.

Vocational interest tests are given by many universities in order to guide their students in the selection of proper vocations. The test is in the form of a series of questions for which one of three answers (Likes; Indifferents; Dislikes) is checked by the examinee. Typical questions are: Do you like motion pictures? Do you like to repair automobiles? Would you like to be an actor? The test is graded by assigning, for each answer, a predetermined "weighted" numerical score to each vocation. Thus, in answer to the question "Would you like to be an actor?" the weighted scores might be:

	Likes	Indifferents	Dislikes
Physician	12	0	- 3
Lawyer	10	- 1	- 4
C.P.A.	- 10	0	5

The scores assigned for each type of answer are determined in advance from averages obtained from the answers submitted by large groups of persons considered successful in their particular vocations.

The test is graded by totalling the scores for all questions by vocations. The vocation registering the highest score is the one for which the examinee is best fitted, the second highest score indicates the second preferred vocation, etc. The Test Scoring Device assigns and totals the weighted scores automatically in the following manner:

A set of prepunched cards, one card for each question on the test, is placed in the feed hopper of the accounting machine. Each card contains three groups of weighted scoring data, one for each potential answer. As each card passes the brushes, the operator presses one of the control keys according to the answer indicated on the test sheet. The depression of a control key causes a field selection of the proper group of scoring data from the prepunched card for the particular question. Thus, the operation is one of selection at the will of the operator. The totals registered in the counters of the accounting machine at the end of the run classify the examinee as to his vocational interests.

The device consists of six multi-contact relays and a three-key control board. The relays are mounted on the accounting machine base and are connected to the control board by a flexible cable. The control board is movable and may be placed anywhere at the convenience of the operator. The device is made operative by a switch which, when "OFF," restores the accounting machine to normal use.

The device, although designed primarily for use in connection with test scoring, can be used in any application where class or field selection of punched data under control of the operator would prove advantageous.

63. What is the Total Transfer Device?

This device provides for the printing of totals in a print bank other than that which is normally associated with the counter in which the total is accumulated. The total is printed on the reset cycle for which the counter dial is set.

For example, a major control total may be automatically printed in the same bank with the minor control totals without shifting the carriage. The following report illustrates the operation of the device.

This device can be made to operate from any counter to any print bank, at any one control change. As many of the devices as are required may be installed on one accounting machine. The device is permanently affixed so that it will perform only one transfer, although a switch is provided to cause the printer to operate normally or to transfer. In order to distinguish between the classes of totals printed in the same bank, the asterisk, or other desired symbols, can be made to print opposite on the transferred totals.

NORMAL OPERATION — Switch "Off"

Counter 3 Print Bank 3 Account	Sub	Counter 4 Print Bank 4 Amount for Sub Account	Counter 5 Print Bank 5 Account Total
356	10	40000	
356	14	25000	
356	28	10000	
			75000*
358	11	10000	
358	12	5000	
			15000*

WITH TOTAL TRANSFER — Switch "On"

Counter 3 Print Bank 3 Account	Sub	Counters 4 & 5 Print Bank 4 Sub Acct. Amt. & Account Total	Print Bank 5
356	10	40000	
356	14	25000	
356	28	10000	
		75000*	Note that the asterisk prints after transferred amount only
358	11	10000	
358	12	5000	
		15000*	

The total transfer device can be installed on all Type 285 and 297 Electric Accounting Machines.

TABULATOR OPERATIONS

1. How many operating buttons are there and what are their uses?

Vertical Tabulator - Type 91 - 3 - Start - Stop - Reset
Standard Tabulator - Type 90 - 3 - Start - Stop - Reset
Standard Tabulator - Type 92 - 3 - Start - Stop - Reset
Automatic Control Tabulator - Type 93 - 4 - Start - Stop - Minor Reset - Major Reset
Electric Accounting Machine - Type 285 - 3 - Start - Stop - Reset
Electric Accounting Machine - Type 297 - 3 - Start - Stop - Reset
Electric Accounting Machine - Type 302 - 3 - Start - Stop - Reset
Alphabetic Accounting Machine - Type 405 - 4 - Start - Stop - Hand Total - Final Total

2. If the machine is stopped at a point other than "D" or "F" on the timing wheel, what procedure should be followed?

On the Electric Accounting Machines Types 285, 297, 302, and the Alphabetic Type 405, lift the latching clutch armature and turn the machine to "D" on the timing index in the forward direction by means of the drive belt.

3. If the machine does not start when the start key is depressed, what would you check?

Wall Plug
Main Line Switch
Main Line Fuses
Pointer on Timing Index Wheel

4. What machines have an auto-start switch and what is its purpose?

Automatic Control Tabulator - Type 93
Electric Accounting Machine - Type 285
Electric Accounting Machine - Type 297
Electric Accounting Machine - Type 302
Alphabetic Accounting Machine - Type 405

When in the "ON" position the machine starts automatically after the counters have been reset.

5. In what machines can cards be added in the feed hopper while the machine is running?

Vertical Tabulator - Type 91
Alphabetic Accounting Machine - Type 405

6. What precautions must be taken when placing cards in the feed hopper?

Cards must be evened by setting them on the "joggle plate" and then placed carefully in the feed magazine. The pressure plate should then be positioned.

7. How are jammed cards removed?

If cards are jammed in the feeding mechanism, it is necessary to remove the contact roll slide and separate the feed rolls by means of the "feed roll hooks." The damaged card may then be easily removed with the other hand.

8. What precautions should be taken in handling the wires, plugging the machine, and removing the wires?

The main switch should be turned "off" before starting to plug the machine.
Plug wires should be inserted and removed by grasping the jack, not the plug wire.
Plug wires should be removed individually - never grasp a whole row at a time.

9. Can one counter be divided so that it can be used simultaneously for adding and indicating purposes? If so, how?

One counter on the Vertical Tabulator, Type 91, and the Standard Tabulators, Types 90 and 92, can be split by means of a "split" switch and half of the counter us used for adding.

One counter on the Automatic Control Tabulator, Type 93, Electric Accounting Machines, Types 285, 297, 302, and Alphabetic Accounting Machine, Type 405, may be split for group indication by plugging as many hubs as necessary through the G.I. unit.

10. If the accumulating collar of a counter is engaged, what is accomplished?

On all machines equipped with the accumulating collar, the counter will clear at each control change if the accumulating collar is engaged.

When the collar is disengaged, the counter will not be cleared on the reset.

11. What is the purpose of the auto-reset switch?

The purpose of the auto-reset switch is to clear the counters and print the total automatically at the end of a group. Only the printing tabulators are equipped

4. What machines have an auto-start button and what is its purpose?

Automatic Control Tabulator - Type 93
Electric Accounting Machine - Type 285
Electric Accounting Machine - Type 297
Electric Accounting Machine - Type 302
Alphabetic Accounting Machine - Type 402

When in the "Off" position the machine starts automatically after the counters have been reset.

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Vertical Tabulator - Type 91
Alphabetic Accounting Machine - Type 402

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with this feature.

12. Can more than one total be carried in one counter?

When two or more totals to be accumulated do not exceed the total digit capacity of the counter, one counter can be used to add and accumulate these totals.

13. What is the position of the accumulating collar when the counter is to be used to accumulate a progressive total?

The accumulating collar is disengaged.

14. Is it possible to clear one part of a counter without clearing the other? For example, is it possible to clear the adding part of a split counter without clearing the indicating part?

No, the whole counter is cleared as a unit.

15. How may counters be reset without printing the figures on the report?

The printing of the total may be suppressed by means of the "non-print" switch or by the use of the "Hammer Locks."

16. Can type bars be adapted to the requirements of a particular type of work, that is, can type bars be used to print special symbols and letters?

Yes, any printing tabulator can be so equipped. By using special demountable type bars, it is also possible for the operator to make changes in the type set-up.

17. What is the distance from center to center of adjacent type bars?

The distance from center to center of adjacent type bars is 5/32".

18. What is the space between printing banks?

Electric Accounting Machines Type 285, 297, and 302 - 5/16"
Alphabetic Accounting Machine Type 405 - 5/32"

19. What arrangement of Tension Levers is necessary to obtain proper type impressions when making several carbon copies?

On the Electric Accounting Machine Types 285, 297, and 302, tension levers are provided. By pulling these levers down, it is possible to increase the striking force of the hammers for printing several carbon copies.

The Alphabetic Accounting Machine is not equipped with tension levers.

20. How is the Card Counting Device plugged to count cards?

A plug wire from the hub marked "CC" to any unused counter or counter where the full capacity is not being used will cause a "1" to be added for every card passing through the machine. Only certain classes of cards may be counted by plugging the "CC" hub through a class selector.

21. Are stop cards included in the card count if they are used for controlling?

The Vertical Tabulator Type 91, and Standard Tabulators Type 90 and 92 do not count stop cards.

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The Automatic Control Tabulator Type 93, the Electric Accounting Machines Types 285, 297, and 302, and the Alphabetic Accounting Machine Type 405 do count stop cards.

22. What will the machines equipped with automatic control do if one of the cards is not punched in one column of the control field?

The machine will work the same as it does when there is a change of punching in the control columns, that is, it will stop, print a total, and reset those counters which are engaged.

23. What is the position of the major and minor control shunt plugs when using them in controlling?

The major shunt plug is always plugged to the left of the minor in the row of hubs provided for the shunt plugs.

24. Is it possible to use Major control without using Minor?

Yes, it is possible to use only the major and not the minor when controlling.

25. How is it possible to obtain a grand total of a number of sub-totals?

Wire the same card column into two counters and leave the accumulating collar of one of the counters "disengaged."

The major or grand total appearing in the accumulating total counter will be the sum of the minor or sub-totals.

26. It is desired to punch a credit for goods returned amounting to $17.20 in the amount field of 7 columns, 39 to 45 inclusive. What should be punched in order that the net amount of the sales may be obtained in an adding counter?

The card should be punched 99982.80.

27. What is the purpose of the complement switches?

When used with an adding counter the complement switch suppresses the printing of the carry-over in the ninth position caused by complement figures being added into the counter to print the net figure.

28. How is the class selector plugged for elimination, counter selection, field selection?

Elimination

1. Plug the adding brushes for the field to the common of the class selector.
2. Plug the "NoX" side of the class selector to the counter (X's eliminated), or plug the "X" side of the class selector to the counter ("NoX" cards eliminated).
3. Plug the class selector pick-up to that column of the control brushes having the X punch for controlling the adding or elimination of the card.

Counter Selection

1. Plug the adding brushes for the field to be class selected to the common of the class selector.
2. Plug the "NoX" side of the class selector to the counter in which the total of the "NoX" cards is to be accumulated.
3. Plug the "X" side of the class selector to the counter in which the total of the "X" cards is to be accumulated.

4. Plug the class selector pick-up to that column of the control brushes having the X punch for controlling the class selector.

Field Selection

1. Plug the adding brushes for one field to be selected to the "NoX" side of the class selector. (The field to be read when there is no "X" in the card.)
2. Plug the adding brushes for the other field to be selected to the "X" side of the class selector. (The field to be read when there is an "X" in the card.)
3. Plug the class selector common hubs to the counter in which the total is to be accumulated.
4. Plug the class selector pick-up to that column of the control brushes having the X punch for controlling the class selector.

MECHANICS OF TABULATORS

1. How are cards fed into the machine?

The cards are fed to the first feed rolls by the card feed knife.

2. How many sets of brushes in the tabulator? What are their purposes?

	Adding Brushes	Control Brushes
Vertical Tabulator Type 91 - - - - - -	Yes	No
Standard Tabulator Type 90 - - - - - -	Yes	No
Standard Tabulator Type 92 - - - - - -	Yes	No
Automatic Control Tabulator Type 93 -	Yes	Yes
Electric Accounting Machine Type 285 -	Yes	Yes
Electric Accounting Machine Type 297 -	Yes	Yes
Electric Accounting Machine Type 302 -	Yes	Yes
Alphabetic Accounting Machine Type 405 -	Yes	Yes

The adding brushes are used to sense the electrical impulses that are to be transmitted to the counters. The control brushes are used to sense the electrical impulses that will control the automatic operation of the machine.

3. How are the brushes on the tabulator wired?

Each brush is connected to a wire which carries the electrical impulse to the adding brush hubs on the plugboard.

4. What is the chief advantage of the plugboard?

The chief advantage of the plugboard is the speed and ease with which various reports involving a different grouping of information may be obtained from a single machine.

5. What is the chief advantage of the automatic plugboard?

The speed with which the plugboard set-up may be changed by inserting another previously plugged plugboard for another report.

6. What is meant by the Carry-Over Position?

It is the last position to the left in a counter, which is used for accumulation of the carry-over from the counter wheel to its right. It is not operated by a magnet and consequently cannot be used for the addition of digits greater than one.

4. Plug the class selector pick-up to that column of the control brushes having the X punch for controlling the class selector.

Field Selection

1. Plug the adding brushes for the field to be selected to the "X" side of the class selector. (The field to be read when there is no "X" in the card.)
2. Plug the adding brushes for the other field to be selected to the "X" side of the class selector. (The field to be read when there is an "X" in the card.)
3. Plug the class selector common hubs to the counter in which the total is to be accumulated.
4. Plug the class selector pick-up to that column of the control brushes having the X punch for controlling the class selector.

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Electric Accounting Machine Type 285 -	Yes	Yes
Electric Accounting Machine Type 297 -	Yes	Yes
Electric Accounting Machine Type 302 -	Yes	Yes
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7. How is group control obtained through the use of control brushes?

The control brushes read the information punched in the control field at the same time that adding brushes are reading the same information. If the two fields compare, a circuit is completed to hold the motor control relay energized and the drive motor running. If the control fields do not compare, the motor stops and the machine will stop at the end of the group.

8. What is the principle of operation of the counter?

The counter is operated by a timed electrical impulse. A constantly revolving shaft synchronized with the feed is clutched in with the counter wheel by the impulse through the hole in the card. This impulse energizes the counter magnet and trips the armature latch, engaging the counter wheel. The wheel is carried around to after "C" on the index when all the engaged wheels are declutched together.

9. How are the counter wheels reset to zero at the end of a group?

The reset motor is set into operation, turning the reset shaft. If the accumulating collar or clutch is engaged the reset gear will drive the counter wheel shaft. The counter wheel shaft has a shoulder cut in it into which two small pawls inside the counter wheel engage to turn the wheel back to zero.

10. How are the totals transferred from the counter to the printed report?

The counter wheels are geared to the top counter brushes and the figure in the wheel positions the top counter brush on the proper segment in the top counter molding. The brush remains stationary on the top counter segment during the printing operation. Each position in the counter is, during the total printing operation, connected to the corresponding print magnet. The magnet, however, is not energized until the proper time when the emitter completes the circuit and trips the stop pawl. The emitter is synchronized with the print head so that only when the proper tooth of the type bar is opposite the stop pawl is this circuit completed. Completing this circuit trips the stop pawl and stops the type bar at the figure in the counter. The type bar is held in this position until after the hammers trip and the total is printed. After the printing is complete the reset mechanism resets the counters and returns the print unit to its normal position.

PRODUCTS OF
INTERNATIONAL TIME RECORDING DIVISION

LESSON NO.

MANUAL OF SALES INSTRUCTION

INTERNATIONAL BUSINESS MACHINES CORPORATION

EDUCATIONAL DEPARTMENT

ENDICOTT, N. Y.

PRINTED IN U. S. A.

FORM 1—55—1

INTERNATIONAL TIME RECORDING DIVISION

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THE FIELD AND PURPOSE OF INTERNATIONAL TIME RECORDING PRODUCTS

The First Standard Measure for Labor Time

The foundation upon which the International Time Recording Division has been erected is the MONEY VALUE OF THE BUSINESS MINUTE. Our present world-wide business structure has evolved from the invention of a mechanism for measuring accurately the time that factory employees spend on the premises of their employers.

On the surface, this invention seemed only a mechanical means of doing what time clerks and foremen had been doing manually ever since time had become an article of value that could be exchanged for remuneration of some sort. On looking deeper into the proposition, it becomes apparent that the change from manual to mechanical time recording was the least important of the changes involved. The major change was that the business world had been given a fixed standard for measuring time. Time, as a merchantable commodity, had been placed on an equal basis with all of the other materials entering into the production of manufactured goods. The employee could sell and the employer could buy time over the Time Recorder in the same manner that iron and steel changed hands over the scale -- a given quantity at a fixed price per unit.

Industrial Acceptance of Mechanical Time Recording

The elimination of the human element in determining how much time the employee had delivered and how much time the employer should pay for amounted to a revolutionary step in business procedure. However, like many other major improvements, its value was not realized immediately. Human unwillingness to change; fancied advantages under the manual system; inability to realize the increased benefits to both employer and employee made the task of distributing the new machines and securing their universal acceptance a real selling job. That job is not yet completed.

It may be stated that the majority of the employers of labor have accepted the time recorder as a necessary tool of business - if we differentiate between hourly laborers and salaried employees. Within very recent years a salesman could not even secure serious attention to the suggestion that office employees and other salaried workers should account for their time in the same manner as workers hired on an hourly basis.

The last few years have opened the eyes of many business executives to the fact that they have been expending time, energy and money to cut production costs in the factory only to lose the savings effected through inefficient offices. Production methods were not until lately considered applicable to office routines. As a

result of this viewpoint, the field for time recording equipment in offices is practically untouched today, except for the larger establishments.

Time Indication in the Factory

The next step forward after the invention of the time recorder was to explode the false assumption that a time piece inside of a factory would make "clock watchers" of all of the employees within reading distance of it. Actual trial showed that the employee who could see the passage of time gauged his activity by the clock and, contrary to previous assumptions, increased his production. Thus, there was added to our company's function of recording time, the indicating of time, and as a natural outgrowth of this function, the signalling of time to mark the beginning and ending of timed periods was undertaken.

Synchronization of Time Recording Units

The growth of individual business organizations gave rise to establishments where a number of recording and indicating units was required to equip a single plant. Because the units were controlled individually, each by its own clock mechanism, the synchronizing of all of the units in a single plant became a serious problem. The wall clock might show one time, the starting blast of the whistle signal another time and each of the recorders print still another. This problem was attacked first by the manufacturers. They employed "clock men" whose major duties were to wind the clocks and keep them operating in unison. Realizing the necessity for means whereby any number of recording units could be made to produce comparable time records, our company set about the production of uniform time and developed what was known as the synchronized system.

The Synchronized System

In this system the clocks were individually driven by springs but were controlled from a single master clock by replacing the individual pendulums with electric escapements. This achievement was a long step forward in that it opened the way for centralized control with complete operation of a system of any size from one control panel.

The Minute Impulse System

Some inherent defects of the synchronized system and the continued necessity for employing a clock-winder led to further development work and the production of the "minute impulse clock system." In

this system, all of the individual units were changed. The old spring motor and train of clock gears were replaced by a simple electrical mechanism that received an impulse of electrical energy once each minute and moved the minute hand of the clock or the minute wheel of the time recorder forward one minute for each impulse. Clock winding was eliminated and absolute synchronism was very nearly achieved. The major defect of the system was not in the design or operating principle of the clock, but could be readily traced to the source of electrical current and the accurate transmission of this current to every unit in the system. Because the synchronism of the system depended absolutely upon the transmission of one impulse each minute, the whole system was only as good as the electrical current supply.

The Self Regulating System

The difficulties involved in maintaining an unfailing source of current, together with some inherent sources of trouble, lead to the final achievement of a system in which each subsidiary unit was automatically checked with the master clock at the end of every hour and any errors corrected. Current lapses up to 15 minutes in length could be corrected at the end of the hour during which current was restored and, by extending the correction period, a total of 45 minutes of current failure could be corrected. THE FULLY AUTOMATIC HOURLY SUPERVISED AND SELF-REGULATING SYSTEM HAD BEEN ACHIEVED.

Development of the Time Stamp

Along with the development of our basic time system by unceasing experiment and engineering effort, the field of application was constantly broadening. The necessity of fixing responsibility for the receipt and dispatch of correspondence, documents and legal papers brought about the development of a time recorder adapted to stamp a time record upon sheets of paper - the Time Stamp. The quality of our products and the ability of our engineering force are attested by our fully automatic Time Stamp, the only machine of its kind that automatically changes the dates to agree with long and short months, even to the extent of adding the 29th day to the leap-year February.

Development of the Cost Recorder

Competition in business and the production of numerous classes and styles of goods in manufacturing plants brought about the problem of determining which articles were being sold at a profit and which at a loss. It became necessary to know not only how much time the employee spent on the employer's premises, but also how much time he spent on each particular article upon which he worked. To meet this

need, the International Time Recording Division brought out the Job Clock or Cost Recorder. A card, known as the "job ticket," was stamped at the start and finish of every job or operation. The time per job was thus accurately and automatically recorded and was no longer the result of an employee's estimate of the time expended in doing the work required.

Institutional Time Systems

Synchronized plant time paved the way for synchronized institutional time. Educational costs were steadily rising; curricula were being expanded; quarters were becoming restricted. One method of alleviating these conditions was to insure maximum educative effort during every minute of every school session. Departmentalized instruction was introduced. Pupils were moved from class to class in order that specialists might be employed to teach each particular subject of the curriculum. The movement of a school population of hundreds or thousands of pupils from room to room six to eight times every school day presented a major problem of time and schedule control. There could be no overlapping of lesson periods. Every class must be ready to move out on schedule to prevent confusion and waste. International Time Signalling provided accurate, properly spaced bell signals. International Time Indication gave the instructor the measure by which to gauge the progress of his recitation. Every bell in every room rang at the same instant; every clock hand moved in perfect synchronism with every other and all in precise agreement with one accurate master clock. There was no confusion of signals and no excuse for a recitation running overtime or undertime.

The use of students as dispatch carriers between the school office and the individual class rooms to permit principals to communicate with teachers proved slow and wasteful. International Intercommunicating Telephones placed every teacher and other employee in the school at the principal's finger tip.

Departmentalized instruction and necessity for economy gave rise to larger school plants. Student groups increased from hundreds to thousands. The hazard from fire and panic demanded that pupils be trained to evacuate buildings promptly. The evacuation of a large group from a number of rooms could be effected only by simultaneous signals in all parts of the school plant in case of emergencies. The International Fire Alarm System was developed to meet this need.

With the increase in the size of school plants, the dissemination of information to the student body became a problem, even with the intercommunicating telephone system. Coincident with this problem came the broadcasting of educative material over the air. A need arose for means whereby a school principal could address his entire student body without the waste of time and disruption of routine re-

quired to call the students in a "general assembly" in the school auditorium. There existed also a need for a mechanism capable of receiving educational broadcasts and distributing them to certain rooms of the school. Both of these needs are met by International Central Control Radio, Music and Speech equipment.

With the growth of the country as a whole, the necessity arose for placing certain functions of government on a more business-like basis. The small City Hall and County Court House gave way to large office buildings housing hundreds of employees. The principle of time being a merchantable article has finally been accepted here and International Dial Recorders are the ideal measuring instruments for the time of such employees.

Time Control Applied to Retail Merchandising

The development of chain store merchandising brought about a condition wherein the money value of the store minute was brought to the front. Under the operating policy of some chains, the margin of profit in some units is so small that in certain cases opening a few minutes late and closing a few minutes early will cause the unit to operate at a loss instead of at a profit. The problem here was that of insuring that the store be opened promptly and kept open until closing time. The International Recordolock solves this problem. It definitely places responsibility for variations from schedule upon the individual possessing the key that locked or unlocked the store.

Reasons for the Company's Growth

Through a process of continuous growth, the field of application for the products of the International Time Recording Division has expanded from that of measuring the attendance time of hourly labor to the point where it embraces business, education, government and religion. The company's growth has been the result of the vision and foresight of its executives in sensing and analysing needs in respect to time and its relation to the world's business and of the ability and inventive genius of its engineering staff in defining the problems involved and then solving these problems.

The seeming diversions from the problems of time indicated by the development of fire alarms, telephone systems and central control radio, music and speech equipment are not such in fact. These are rather pointed examples of the broad concept of the control and conservation of time that has guided the definition of the company's field of activity.

I. T. R. Products -- Their Functions and Outlets

TIME -- considered as a commodity -- is the only ingredient that enters into the production of every article of commerce. Whatever is produced or distributed gains a major part of its value from the time required to produce it and convey it to the ultimate consumer.

The field of application of I. T. R. products includes practically every phase of human activity, because, in one way or another, the activities of every individual are gauged "by the clock."

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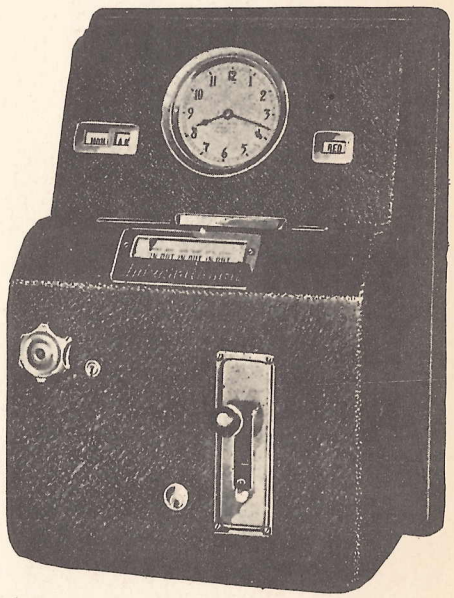
I.T.R. PRODUCTS

1. International Card Recorders

The International Card Recorder is a time recorder designed to furnish a mechanically accurate printed record of the arrival and departure time of an employee on an individual time card. One time card is issued in advance for each employee assigned to the records. It is marked with his number and name and dated for the pay period.

The mechanical accuracy of time furnished by a Card Recorder exerts a constant influence on employees to keep the time or working schedule.

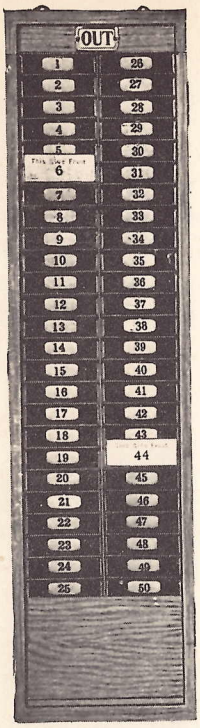


The Card Recorder is a machine comprising an accurate time-keeping mechanism which drives a set of type wheels, known as the printing mechanism, an automatically positioned two-color ribbon, a card receiver for placing the time card into position for registration and an operating lever.

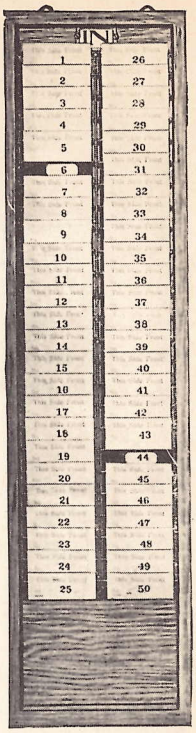
Two card racks are provided to retain the cards. One, marked IN, is mounted on one side of the recorder and the other, marked OUT, is installed on the opposite side of the recorder.

The Card Recorder and individual time cards are manufactured in various models to cover definite pay periods and various working schedules. With the use of a Card Recorder, recording of time is made easy and fast; and compact, accurate, legibly printed records, easy to compile and file for reference, are made available.

One day s time record on the time card is normally across one horizontal line from left to right. The number of days in the pay period determines the number of horizontal lines on the time card. The automatic card lift (abutment) changes from day to day automatically at a predetermined time set-up on the recorder.

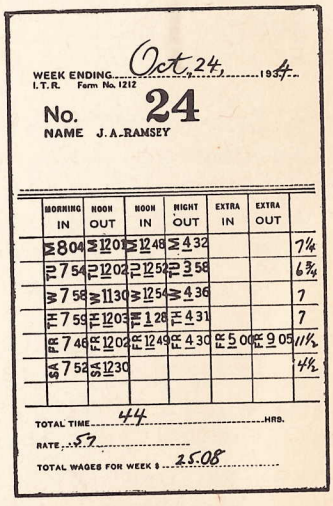


The IN and OUT registrations are spaced across on the horizontal line each day. This spacing is usually automatically set up in the recorder on a predetermined schedule. Where the automatic IN and OUT spacing is used, the employee cannot change in any way the location of his registration.



The Automatic Two Color Ribbon prints irregular time in red and regular time in blue.

A predetermined schedule of hours is set up on a schedule wheel which automatically makes the recorder print in blue before starting time; change to red after starting time and print red until lunch time. During the lunch period, the recorder will print in blue, and after starting time following luncheon, the recorder will print in red again until closing time when it automatically prints blue again. Where overtime records are necessary, the recorder can be set to print in blue for closing time until supper time is over and then print red again until the next morning.



WEEK ENDING Oct. 24, 1934
I.T.R. Form No. 1212

No. 24
NAME J. A. RAMSEY

	MORNING IN	NOON OUT	NOON IN	NIGHT OUT	EXTRA IN	EXTRA OUT	
M	8 04	12 01	12 48	4 32			7¼
TU	7 54	12 02	12 52	3 58			6¾
W	7 58	11 30	12 54	4 36			7
TH	7 59	12 03	1 28	4 31			7
FR	7 46	12 02	12 49	4 30	5 00	9 05	11½
SA	7 52	12 30					4½

TOTAL TIME 44 HRS.
RATE .57
TOTAL WAGES FOR WEEK $ 25.08

International Card Recorders are furnished in either wood case, clock driven models; or in metal case, electrically driven models. Wood cases are olive green finish; metal cases, green morocco with metal trim. Other standard finishes are available.

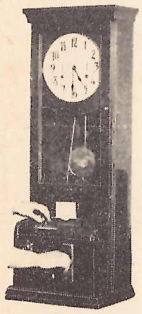
The recorders are equipped with indicators showing the date or day; A.M. or P.M.; and the color in which the machine is set to print.

The type wheels in International Card Recorders may be driven by three different methods.

1. The most modern and accurate method, especially when more than one time indicating or recording unit is involved, is the International Self-regulating electric drive. By this method, the type wheels are driven by timed electrical impulses from a master clock. Recorders so driven have no clock mechanism but are operated by an electromagnet which receives its impulse from the control system, setting the type wheels forward one minute for each impulse received. They require no winding or regulating. The hourly supervised type of drive can be operated by a plain "minute impulse" control system, but only by sacrificing the self-regulating feature of the machine.

2. When only a single recorder is required, satisfactory results may be secured with the synchronous motor drive. By this method, the type wheels are geared to a small synchronous motor which is operated by current taken from the nearest alternating current service outlet. The recorder will, of course, lose time if current interruptions occur.

3. The oldest method of driving a recorder, which is today practically obsolete, except where supervised alternating current, free from interruptions cannot be secured, is the direct spring drive or clock drive. To meet such conditions, International furnishes its clock driven, long wood case recorder.



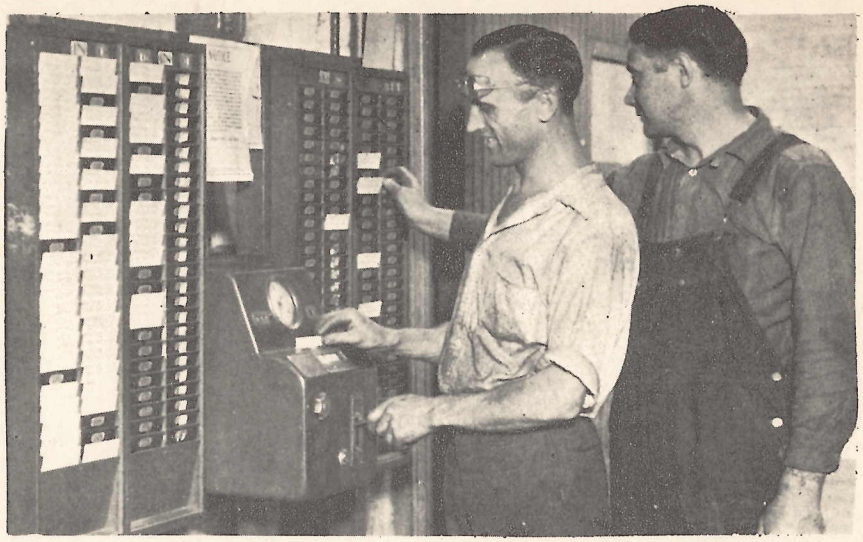
The type wheels in this machine are driven by an 88 beat, key-wound, double spring, pendulum escapement, eight-day clock movement. The clock movement is set and regulated as any hand-wound pendulum clock.

Installation: -- A Card Recorder is usually installed on a wall or pipe rack between two card racks. The rack marked OUT is placed toward the exit side of the plant or department, and the one marked IN on the opposite side of the recorder. Proper installation should consider the speed of passage of a line of employees past the recorder and racks. The racks should be placed far enough from the recorder to enable each employee to find and remove his card or to insert it into the other rack while the next employee is making his registration operation.

The International Bell Ringer, which may be attached to the Card Recorder and some other types of equipment for a small additional cost, should be applied where an individual self-contained recorder is to be used. It provides a means of automatically sounding a bell, gong, or horn at starting time and stopping time.

This device may be set up for five minute warning signals before regular signals.

The International Bell Ringer, when properly explained, sells itself and frequently is a major factor in the sale of a recorder.



Where several recorders are used, it may be desirable to equip each recorder with a symbol printing wheel which will identify the recorder used.

An International Card Recorder should be used whenever men and women are employed and paid in accordance with their observance of a time schedule.

All over the world International Card Recorders have been in use for many years.

An employer of labor should buy an International Card Recorder because it maintains an indisputable record of his employees' time, which is far more accurate and dependable, and less costly, than any hand method he could use.

INTERNATIONAL TIME RECORDERS TELL THE TRUTH ABOUT TIME!

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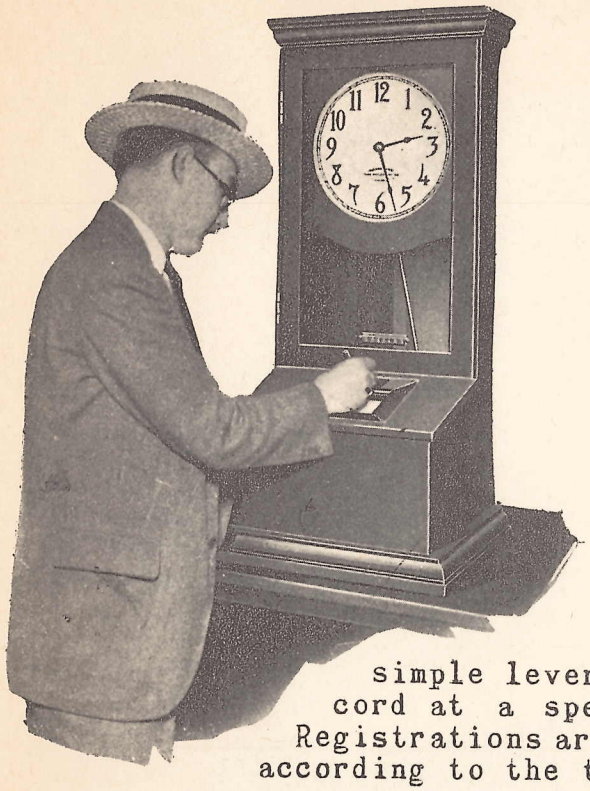
2. International Autograph Register

The International Autograph Register is a distinctive type of time recorder. It differs from all other types of International Recorders in that it requires the signature of the employee to identify and complete his attendance record.

This type of recorder was designed to prevent collusion among the employees where the isolated location of a recorder, and the lack of

supervision, showed the need for positively identified time records.



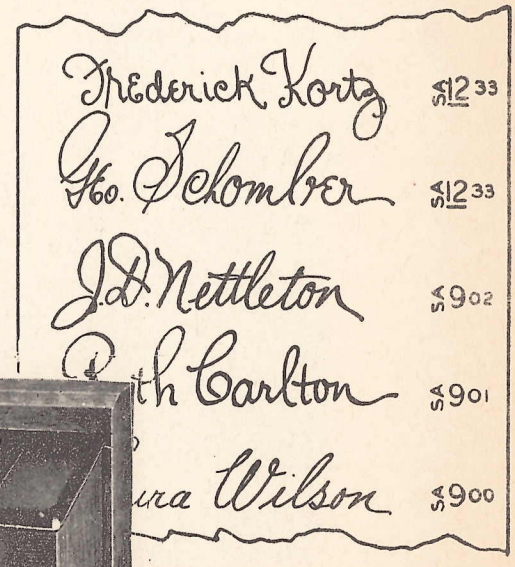
The International Autograph Register establishes absolute identity of the person using it, together with his time record, on a paper tape four inches wide, which is supplied as needed from a large roll placed within the recorder. Each employee, upon arriving or departing, depresses the lever of the Autograph Register. This simple operation of depressing the operating handle prints the time record, moves the paper tape forward, exposes it for signature and for explanation, when desired; and also insures that the signature and time record will appear on the same line and be secured under lock and key as soon as the handle is released.

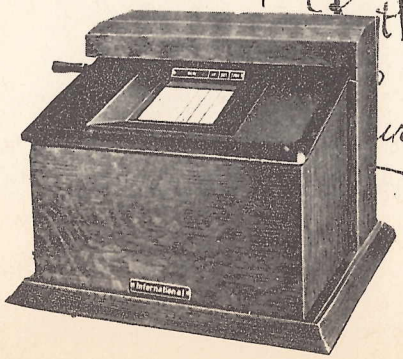
The ease and simplicity of this simple lever operation makes it possible to record at a speed of six to ten persons per minute. Registrations are listed on the paper tape and grouped according to the time made, or in chronological order.

The long case recorder is available with a clock face, a full length mirror, or bulletin board. Long case recorders are furnished with an eight-day, key-wound movement.

The desk type recorder is driven either by a synchronous motor, or by an electric clock system.

The Autograph Register is especially applicable for use at any location where a small number of persons are employed and supervision is delegated to a person who is absent most of the time; also for recording tenants' visits to office building after regular hours and for watchmen, safe deposit vaults, special overtime workers, etc.





The desk type Autograph Register overcomes the objections to the appearance of a time clock and is highly desirable for office employees.

Where merchants and small manufacturers are required to leave their establishments, an Autograph Register furnishes assurance that the employees are on the job. It is also used as an auxiliary recorder to verify overtime records on card or dial recorders. The temptation or possibility of making false records is eliminated because it is impossible to tamper with the records of an Autograph Register.

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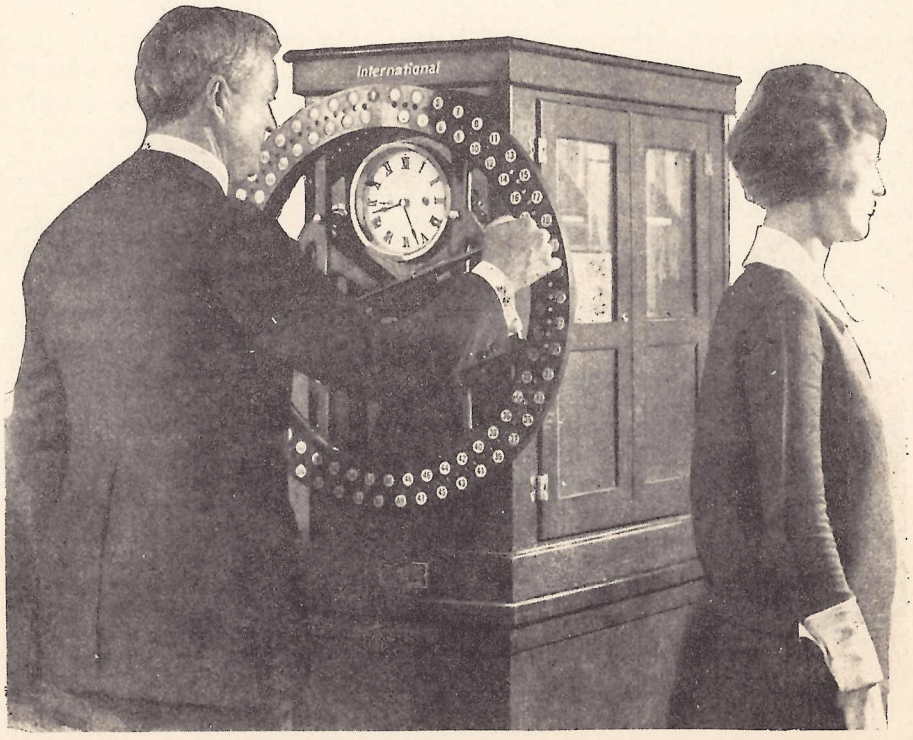
3. International Dial Recorders

The Dial Recorder is a machine which furnishes on one sheet, the daily IN and OUT registrations of employees. A blank payroll register form is placed within the Dial Recorder at the start of a payroll period.



The simplicity of operating the Dial Recorder makes for speedy registrations with the least possible effort. The employee places the registering lever at the position of his number and pushes it.

A bell is rung which serves notice that the registration has been made upon the payroll sheet.

The International Dial Recorder is the only time recorder that prints the original figures from which the payroll is prepared, directly on the payroll sheet itself. Every other type of attendance recorder requires one or more supplementary operations to prepare the detailed records for executive use.

The Dial Recorder is the only time recorder manufactured that maintains complete supervision over the making of registrations. It is mechanically impossible to print one registration over another. (An exclusive feature.)

One employee can register IN, be at once excused for the day, and register OUT. His registrations will be automatically placed in sequence and not affect the spacing of any other employee's registrations. All so-called fully automatic card recorders are set at predetermined schedules to space for the IN and OUT registrations, whereas the Dial Recorder spaces automatically and instantly whenever a registration is made.

Dial Recorders are made in three different sizes, for 50, 100, and 150 employees, and for three different pay periods; namely, -- daily, weekly, and eight-day or quadri-monthly.

The daily dial sheet provides a pre-numbered line for each employee with space for six registrations per number. These daily sheets are usually extended and totaled each day and pasted to a payroll form which covers a payroll period.

The weekly and quadri-monthly dial recorders are made in standard model and in payroll model. The record sheet for the standard model provides ample space for the employee's name and extensions of total hours, rate and amount. The record sheet for the payroll model provides ample space which may be ruled off or divided as desired to accommodate complete payroll information. The payroll dial sheet is usually designed to each user's individual specifications.

The Automatic Two Color Ribbon is available on all Dial models and serves the same purpose as on the Card Recorder, to distinguish irregular registrations accurately and easily.

All models of Dial Recorders are available with eight-day, key wound, pendulum-driven clock movement; minute impulse movement driven from a master clock system; or synchronous motor drive from 110 AC supervised commercial power supply.

1	857 1201 1257 502
2	859 1202 100 504
3	858 1231 127 503
4	901 1202 1257 502
5	859 1201 100 507
6	900 1233 129 503
7	857 1231 127 502
8	858 101 200 510
9	900 1202 1257 504
10	857 1201 1259 502
11	900 102 200 512
12	858 1231 127 503
13	900 103 200 502
14	857 1202 1259 507
15	858 1201 1257 503
16	1200 508
17	857 1231 128 502
18	900 101 200 505
19	859 1232 129 509
20	857 1201 1258 503
21	857 1201 1257 502
22	859 1202 100 504
23	858 1231 127 503
24	900 1202 1257 502
25	859 1201 100 507
26	900 1233 129 503
27	857 1231 127 502
28	858 101 200 510
29	900 1202 1257 504
30	857 1201 1259 502
31	904 102 200 512
32	858 1231 127 503
33	900 103 200 502
34	857 1202 1259 507
35	858 1201 1257 503

PAY ROLL PERIOD ENDING Friday July 17, 1931

DAY 7TH	DAY 6TH	DAY 5TH	DAY 4TH	DAY 3RD	DAY 2ND	DAY 1ST		NAMES	TOTAL HRS.	RATE	AMOUNT	DEDUCTIONS	AMOUNT DUE
	1	652 1203 1250 440	8.6	8.6	100	8.6	29 15	5.	C. G. O'DONNELL	52.7	54	28 46	3 00	25 46
	2	656 1200 1256 436	8.6	8.6	8.6	8.6	8.6	5.	A. B. BROWN	48-	54	25 92		25 92
	3	650 1201 1254 438 500 800	8.6	8.6	8.5	8.6	8.6	5.	L. E. CLINTON	50.9	45	22 91	60	22 31
	4	657 1200 1249 441	8.6	8.6	8.6	8.6	8.6	5.	A. W. TYLER	48-	48	23 04		23 04
	5	651 1202 1257 438	8.6	8.6	85	8.6	8.6	5.	A. C. POWERS	47.9	40	19 16		19 16
	6	654 1200 1253 437	8.6	830	8.6	8.3	8.6	4.9	F. R. DOWNING	50.5	58	29 29	1 20	28 09
	7	710 1201 1259 440	8.4	8.6	8.6	8.6	8.6	5.	J. G. MURPHEY	47.8	60	28 68		28 68
	8	650 1200 1252 437	8.6	8.6	8.6	8.6	8.6	5.	R. E. ELDRIDGE	48-	60	28 80	40	28 20
	9	658 1203 1249 438	8.6	8.6	800	8.6	8.5	5.	G. A. FRYE	50.3	40	20 12		20 12
	10	653 1200 100 436	8.6	5.0	8.6	8.6	8.5	5.	H. P. GREY	43.3	56	24 25		24 25
	11	652 1201 1250 441	8.6	8.6	8.6	8.5	8.6	5.	C. E. LINCOLN	47.9	54	25 87		25 87
	12	656 1202 1256 437	8.6	8.6	800	8.6	8.6	5.	H. R. BARBER	50.4	60	30 24	3 00	27 24
	13	650 1200 1254 436 500 850	8.6	8.6	8.6	8.6	8.6	4.5	E. M. MASON	49.1	60	29 46	3 00	26 46
	14	657 1200 1249 438	8.6	8.6	8.6	8.6	8.6	5.	B. C. DECKER	48-	60	28 80		28 80
	15	651 1203 1258 437	8.6	8.6	8.6	8.6	8.6	5.	G. C. HARLAN	48-	45	21 60		21 60
	16	654 1201 1253 436	8.6	8.6	8.6	8.1	8.6	5.	J. W. KINGMAN	47.5	45	21 38	40	20 98
	17	700 1200 1259 440	8.6	8.6	8.6	8.6	8.6	4.7	T. W. VANHOLT	47.3	60	28 38		28 38
	18	650 1202 1252 436	8.6	8.3	700	8.6	8.6	5.	R. F. MORRIS	49.7	54	26 84	60	26 24
	19	701 1200 1249 438	8.5	8.5	8.6	8.5	8.6	5.	L. A. GREENE	47.7	54	25 76		25 76
	20	653 1201 101 436	8.5	8.6	8.6	8.6	8.3	5.	G. A. MACDONALD	47.6	48	22 85		22 85
	76	654 1200 1253 440	8.6	8.5	8.6	8.5	8.6	5.	W. J. BORDEN	47.8	58	26 77		26 77
	77	658 1203 1259 436	8.6	8.5	8.6	8.6	8.6	5.	E. F. LIND	47.9	44	21 08		21 08
	78	650 1200 1252 437	8.6	8.6	8.6	8.6	8.6	5.	H. W. PEGUES	48-	60	28 80	3 00	25 80
	79	701 1200 1249 438	8.5	8.6	8.6	8.6	8.6	4.6	W. F. LILLY	47.5	60	28 50	3 00	25 50
	80	653 1202 115 440	8.3	8.6	8.6	8.6	4.5	5	P. F. SADLER	43.6	46	20 06		20 06
	81	652 1201 1250 437	8.6	8.6	8.6	8.6	8.6	5.	N. M. PADGETT	48-	44	21 12		21 12
	82	656 1203 1256 437	8.6	830	800	8.6	8.6	5.	H. L. DEPASS	54.2	60	32 52	3 40	29 12
	83	650 1200 1203 441	8.6	8.6	8.5	8.6	7.8	5.	T. H. PERRIN	47.1	40	18 84		18 84
	84	657 1203 1249 438	8.6	8.6	7.4	8.6	8.6	5.	H. J. DUPONT	46.8	45	21 06		21 06
	85	651 1202 1257 437	8.6	8.6	8.5	8.6	8.6	5.	F. E. GARRINGER	47.9	45	21 56		21 56
	86	654 1201 1253 441	8.6	8.5	100	8.5	8.6	5.	P. D. DUGAN	50-	60	30 00	3 00	27 00
	87	700 1203 1259 436	8.6	8.6	8.6	8.6	8.6	5	L. T. PARSONS	48-	45	21 60		21 60
	88	650 1200 1252 315	7.2	4.8	8.6	8.6	8.6	5.	E. W. MORGAN	42.8	48	20 54		20 54
	89	659 1202 1249 441	8.6	8.5	8.6	8.6	100	5.	K. H. ROSS	50.4	60	30 24		30 24
	90	655 1200 100 438	8.6	8.6	8.6	8.6	7.5	4.7	R. V. ROSSNER	47.6	40	18 68		18 68
	91	652 1203 1250 441 500 800	8.6	8.6	8.3	8.6		5.	J. K. TOWNSEND	50.7	46	23 32		23 32
	92	656 1201 1256 438	8.6	8.6	8.6	8.6	8.6	5.	H. C. TRACEY	48-	42	20 16		20 16
	93	650 1202 1254 436	8.6	8.6	8.6	8.6	8.6	5.	C. F. WHALEN	48-	60	28 80	40	28 40
	94	657 1200 1249 441	8.6	8.6	8.6	8.6	8.6	5.	P. J. WALKER	48-	56	26 88		26 88
	95	651 1200 1258 441	8.6	8.6	100	8.6	8.6	5.	L. H. STONE	51-	56	28 56	3 00	25 56
	96	654 1203 1253 439	8.6	8.6	8.6	8.5	8.6	5.	H. F. DRENNEN	47.9	44	21 08	3 00	28 08
	97	659 1202 1259 438	8.6	8.6	8.6	8.6	8.6	5.	G. B. ADDISON	48-	60	28 80	60	28 20
	98	650 1200 1252 438	8.6	8.6	8.6	8.5	8.5	5.	J. E. STEVENS	47.9	58	27 78		27 78
	99	701 1203 1249 440	8.5	800	8.6	8.6	8.6	5	W. F. GOINES	50.4	40	20 16		20 16
	100	653 1201 101 436	8.5	8.6	8.6	8.6	8.1	5.	R. E. AGNEW	47.4	60	28 44	40	28 04
									TOTALS	4815.1		2428 90	48 00	2380 90

WEEKLY PASTING SHEET FOR 6030-6031 DIAL SLIPS

FACSIMILE DAILY MACHINE RECORD AND A COMPLETED WEEKLY SUMMARY SHEET

Worcester Mill Spooling Department

PAY ROLL WEEK ENDING September 23 193

CLOCK No. 8

EMPLOYEES	No.						JOB TIME	TOTAL ATTENDANCE TIME	RATE	PAYROLL EXTENSION	PAYROLL ALLOWANCE	PAYROLL TOTAL	DEDUCTIONS INSURANCE	DEDUCTIONS SAVINGS FUND	NET AMOUNT DUE	REMARKS
Harry J. Duffin	1	8 4 12 9 12 7 5 50	8 5 12 9 12 6 5 50	8 5 12 3 1 2 5 50	8 5 12 3 1 2 5 50	8 5 12 9 12 5 5 50	8 5 10 0 1	36¼	37	.563	20 83		20 83	35	1 50	18 98	
William Malcolm	2	8 5 12 3 1 2 5 50	8 5 12 3 1 2 5 50	8 4 12 9 12 7 5 50	8 5 12 3 1 3 5 50	8 5 12 3 1 2 5 50	8 5 12 0 6	37½	38	.45	17 10		17 10			18 35	
Henry S. Chaffe	3	8 5 12 0 6 12 7 5 50	8 5 12 3 10 5 50	8 5 10 1 5 5 10	8 5 12 9 1 3 5 50	9 8 12 9 12 5 5 50	9 0 12 0 3	36¾	37½	.675	25 31		25 31			23 31	
Harold L. Molin	4	8 5 10 1 5 8 5 10	8 5 10 1 5 5 1	8 5 12 3 1 2 5 50	8 5 12 0 12 5 5 50	8 5 10 1 5 5 0	8 5 12 0 9	37½	38	.50	19 00		19 00			19 00	
Nelson Jacobson	5	8 5 12 9 5 10 5 50	8 5 12 9 12 7 5 50	8 5 12 4 12 8 6 10	9 0 10 1 8 5 50	9 0 12 3 1 2 5 50	8 5 12 0 3	37¼	39	.50	19 50		19 50			19 00	
F. M. Amsler	6	8 4 11 9 12 6 5 50	9 9 3 10 4 1 5 9 50	8 5 6 10 2 2 5 0 4	8 5 12 0 1 10 5 0 3	8 5 6 10 2 0 5 0 8	8 5 12 2 3	38	38	.48	18 24					18 24	
Jacob Dalton	7	11 5 70	8 5 12 9 12 5 5 50	8 5 12 3 1 2 5 3	8 5 12 3 1 2 5 50	9 0 12 0 12 5 5 50	9 0 12 0 6	37¾	38½	.48	18 36		18 36			18 96	
D. Vernon	8	8 5 12 3 1 2 5 50	8 5 10 1 5 5 3	8 4 12 9 12 7 5 50	8 5 12 9 1 5 5 0	9 0 10 1 5 5 0	8 5 12 0 3	37½	38	.45	17 10		17 10			17 10	
Samuel Mund	9	8 5 12 0 5 10 5 0 3	8 5 12 0 12 5 5 0	8 5 10 1 5 5 0	8 5 12 0 1 0 5 0	8 5 12 3 1 3 5 50	8 5 12 0 6	37½	38	.475	18 05		18 05		1 50	16 55	
R. S. Jackson	10	8 5 12 9 12 5 5 50	8 5 12 3 1 3 5 50	8 4 12 0 12 5 5 50	8 5 12 3 1 3 5 0	8 5 12 0 12 5 5 0	8 5 12 0 6	37¼	38	.46	17 48		17 48			17 48	
M. S. Hether	11	8 4 12 0 5 12 5 5 0	8 5 12 0 12 5 5 50	8 5 6 12 3 1 2 5 0	8 5 12 3 1 2 5 0	8 5 12 0 12 5 5 50	8 5 12 0 7	36¾	37	.388	14 36	1 50	15 86	35		15 51	
Norman E. Daly	12	8 5 12 3 1 2 5 50	8 5 6 12 3 1 2 5 0	8 4 12 0 12 5 5 0	8 5 6 12 3 1 3 5 50	8 5 8 12 3 1 2 5 0	8 5 12 0 6	37½	38	.425	16 15		16 15	35		15 80	
Maurice Bateman	13	8 5 12 0 8 12 5 5 0	8 5 7 12 0 10 5 0 3	8 5 7 10 1 5 5 0	8 5 12 0 9 1 3 5 0	9 0 12 0 12 5 5 0	9 0 12 0 3	37	37½	.513	19 24		19 24	50		18 74	
John Patterson	14	8 5 10 1 8 5 10	8 5 8 10 1 5 5 1	8 5 8 12 3 1 3 5 0	8 5 12 0 12 5 5 0	8 5 8 10 1 5 5 0	8 5 12 0 9	37¼	38	.388	14 74	1 00	15 74			15 74	
Alfred J. Frost	15	8 5 12 0 5 10 5 0 3	8 5 12 0 12 5 5 0	8 5 12 4 12 8 6 6	9 0 10 1 8 5 50	9 0 12 3 1 2 5 0	8 5 12 0 3	38	39	.363	14 16	1 35	15 51			15 51	
M. S. Rosemann	16	8 4 11 9 12 0 6 5 0	8 3 10 4 1 5 9 5 0	8 6 10 2 0 2 5 0 4	8 5 12 0 1 0 5 0 3	8 5 6 10 2 0 5 0 8	8 5 12 2 3	37½	38	.413	15 69		15 69	35		15 34	
Arthur Malden	17	8 5 12 0 12 4 5 0 1	8 5 12 0 9 12 6 5 0 5	8 5 6 12 3 1 2 5 3	8 5 12 3 1 2 5 50	9 0 12 0 12 5 5 0 2	9 0 12 0 6	38	38¼	.45	17 21		17 21	40		16 81	
Franklin Hensley	18	8 5 12 3 1 2 5 0 6	8 5 5 10 1 5 8 5 3	8 4 12 0 4 12 5 5 0 2	8 5 12 9 1 5 5 0 1	9 0 10 1 5 5 0 1	8 5 12 0 3	37	38	.35	13 30	1 70	15 00			15 00	
Thomas R. Smith	19	8 5 12 0 5 10 5 0 3	8 5 6 12 0 12 6 5 0 1	8 5 5 10 1 5 8 5 0 1	8 5 6 12 0 1 0 5 0 3	8 5 12 3 1 3 5 0 4	8 5 12 0 6	36¾	38	.35	13 30	1 70	15 00			15 00	
Charles H. Farr	20	8 5 12 9 12 5 5 0 6	8 5 8 12 3 1 3 5 0 2	8 5 12 0 4 12 5 5 0 4	8 5 12 3 1 3 5 0 1	8 5 6 12 0 12 5 5 0 1	8 5 12 0 3	37	38	.475	18 05		18 05	40		17 65	
Howard G. Devan	21	8 4 12 9 12 5 7 5 0 1	8 5 12 0 12 8 5 0 2	8 6 8 12 3 1 2 5 1 0	8 5 12 3 1 2 5 0 1	8 5 12 0 12 5 7 5 0 2	8 5 12 0 7	36½	37	.463	17 13		17 13			17 13	
Harold M. Haber	22	8 5 12 3 1 2 5 5 3	8 8 12 3 1 2 5 0 1	8 9 4 12 0 12 5 5 0 1	8 6 8 12 3 1 3 5 0 9	8 8 12 3 1 2 5 4	8 8 12 0 6	37	38	.488	18 54		18 54	35		18 19	
Robert L. Lang	23	8 4 12 0 6 12 5 5 0 6	8 5 12 0 3 10 5 0 3	8 5 5 10 1 5 5 1 0	8 5 12 9 1 3 5 0 3	9 0 12 0 12 5 7 5 0 2	9 0 12 0 3	36½	37½	.463	17 25		17 25			17 25	
John W. Bayer	24	8 5 10 1 8 5 10	8 8 5 10 1 5 5 1	8 8 12 3 1 2 5 0 2	8 5 12 0 12 5 5 0 1	8 8 5 10 1 5 5 0	8 5 12 0 9	37¾	38	.388	14 74	1 50	16 24		1 00	15 24	
C. L. Hoyt	25	8 6 12 0 5 10 5 0 3	8 5 12 0 12 5 7 5 0 1	8 8 12 0 12 6 8 6 0	9 0 10 1 8 5 50	9 0 12 3 1 2 5 0 6	8 8 12 0 3	38¼	39	.35	13 65	2 00	15 65			15 65	
C. W. Fairchild	26	8 4 11 9 12 0 6 5 0	8 3 10 4 1 5 9 5 0	8 6 10 2 0 2 5 0 4	8 8 12 0 1 0 5 0 3	8 6 10 2 0 5 0 8	8 5 12 2 3	37½	38	.363	13 79	1 50	15 29			15 29	
D. Duane Neff	27	8 5 6 12 0 12 4 5 9 2	8 8 12 9 12 6 5 0 5	8 8 12 3 1 2 5 3	8 5 12 3 1 2 5 50	9 0 12 0 12 5 5 0 2	9 0 12 0 6	38	38¼	.413	15 80		15 80			15 80	
J. O. Radway	28	8 5 12 3 1 2 5 0 6	8 5 5 10 1 8 5 3	8 9 4 12 0 12 5 5 0 2	8 5 12 9 1 5 5 0 1	9 0 10 1 5 5 0 1	8 5 12 0 3	37¼	38	.375	14 25		14 25			14 25	
Edward Hohmann	29	8 5 12 0 5 10 5 0 3	8 8 12 9 12 6 5 0 1	8 8 5 10 1 8 5 0 1	8 5 12 0 1 0 5 0 3	8 8 12 3 1 3 0 5 4	8 5 12 0 6	37	38	.375	14 25		14 25			14 25	
L. M. Bartow	30	8 5 12 9 12 5 5 0 6	8 5 12 3 1 3 5 0 2	8 9 4 12 0 12 5 5 0 4	8 5 12 3 1 3 5 0 1	8 5 12 9 12 5 5 0	8 5 12 0 3	37½	38	.563	21 39		21 39	50		20 89	
Michael T. Darcy	31	8 6 12 9 12 5 7 5 0 1	8 5 12 9 12 6 5 0 2	8 6 8 12 3 1 2 5 1 0	8 8 12 3 1 2 5 0 1	8 8 12 9 12 5 7 5 0 2	8 5 12 0 7	36	37	.713	26 38		26 38	50	1 50	24 38	
Edward Gaffney	32	8 5 12 3 1 2 6 5 3	8 6 12 3 1 2 9 5 0 1	8 9 4 12 0 12 5 7 5 0 1	8 6 8 12 3 1 3 0 5 9	8 8 12 3 1 2 5 4	8 8 12 0 6	37½	38	.688	26 14		26 14		1 50	24 64	
John Osterman	33	8 4 12 0 9 12 5 7 5 0 6	8 7 12 9 1 0 5 0 3	8 7 5 10 1 5 5 1 0	8 8 12 9 1 3 0 5 0 3	9 0 12 0 12 5 7 5 0 2	9 0 12 0 3	36¾	37½	.638	23 77		23 77		1 50	22 27	
Roy M. Cunning	34	8 5 10 1 8 5 10	8 8 5 10 1 5 5 1	8 8 12 3 1 2 5 0 2	8 5 12 0 12 5 6 5 0 1	8 8 5 10 1 5 5 0	8 5 12 0 9	37	38	.488	18 54		18 54			18 54	
Harry Fainer	35	8 5 12 9 1 0 5 9 3	8 5 12 0 12 5 7 5 0 1	8 8 12 4 12 8 6 0	9 0 10 1 8 5 50	9 0 12 3 1 2 5 0 6	8 8 12 0 3	38¼	39	.425	16 58		16 58	35		16 23	
H. S. Redmond	36	8 4 11 9 12 0 6 5 0	8 3 10 4 1 5 9 5 0	8 6 10 2 0 2 5 0 4	8 8 12 0 1 0 5 0 3	8 5 6 10 2 0 5 0 8	8 5 12 2 3	37½	38	.513	19 49		19 49	40		19 09	
S. G. Newman	37	8 5 12 0 12 4 3 5 0 1	8 8 12 9 12 6 5 0 5	8 8 12 3 1 2 5 3	8 8 12 3 1 2 5 50	9 0 12 0 12 5 5 0 2	9 0 12 0 6	38	38¼	.363	13 88	1 50	15 38		1 00	14 38	
John J. Kane	38	8 5 12 3 1 2 5 0 6	8 5 5 10 1 8 5 3	8 9 4 12 0 12 5 5 0 2	8 5 12 9 1 5 5 0 1	9 0 10 1 5 5 0 1	8 5 12 0 3	37	38	.35	13 30	1 70	15 00			15 00	
Geo. Anderson	39	8 5 12 0 5 10 5 0 3	8 6 12 9 12 6 5 0 1	8 6 5 10 1 8 5 0 1	8 6 12 0 1 0 5 0 3	8 8 12 3 1 3 0 5 4	8 5 12 0 6	38	38	.388	14 74		14 74			14 74	
William Ranken	40	8 7 12 9 12 5 5 0 6	8 5 12 3 1 3 5 0 2	8 9 4 12 0 12 5 5 0 4	8 5 12 3 1 3 5 0 1	8 5 12 9 12 5 5 0 1	8 5 12 0 3	37¼	38	.388	14 74		14 74			14 74	
J. B. Ellinger	41	8 4 12 9 12 5 7 5 0 1	8 5 12 9 12 6 5 0 2	8 6 12 3 1 2 5 1 0	8 5 12 3 1 2 5 0 1	8 5 12 9 12 5 7 5 0 2	8 5 12 0 7	36½	37	.388	14 36		14 36			14 36	
Edward Caldwell	42	8 5 12 3 1 2 6 5 3	8 6 12 3 1 2 7 5 0 1	8 9 4 12 0 12 5 7 5 0 1	8 5 12 3 1 3 0 5 9	8 8 12 3 1 2 5 4	8 8 12 0 6	37¼	38	.363	13 79	1 25	15 04	35		14 69	
John H. Wagner	43	8 4 12 8 12 5 7 5 0 8	8 7 12 9 1 0 5 0 3	8 5 5 10 1 5 5 1 0	8 5 12 9 1 3 0 5 0 3	9 0 12 0 12 5 7 5 0 2	9 0 12 0 3	37	37½	.35	13 13	1 70	14 83			14 83	
P. Nardi	44	8 5 10 1 8 5 10	8 8 5 10 1 5 5 1	8 8 12 3 1 2 5 0 2	8 5 12 0 12 5 5 0 1	8 5 8 10 1 5 5 0	8 5 12 0 9	37½	38	.413	15 69		15 69			15 69	
Julian Clay	45	8 6 12 9 1 0 5 9 3	8 5 12 0 12 7 5 0 1	8 8 12 4 12 8 6 0	9 0 10 1 8 5 50	9 0 12 3 1 2 5 0	8 8 12 0 9	38	39	.475	18 53		18 53	50		18 03	
M. H. Morgan	46	8 4 11 9 12 0 6 5 0	8 3 10 4 1 5 9 5 0	8 6 10 2 0 2 5 0 4	8 8 12 0 1 0 5 0 3	8 5 6 10 2 0 5 0 8	8 5 12 2 3	37¾	38	.563	21 39		21 39	50		20 89	
David E. He...	47	8 5 12 9 12 5 7 5 0 1	8 8 6 12 9 12 8 5 0 5	8 8 12 3 1 2 7 5 3	8 8 12 3 1 2 9 5 0	9 8 12 9 12 5 9 5 0 2	9 0 12 0 6	38	38½	.513	19 62		19 62	40		19 42	
Ed...	48	8 5 12 3 1 2 5 0 6	8 5 5 10 1 8 5 3	8 8 9 4 12 0 12 5 5 0 2			8 5 12 0 3	37¾	38	.50	19 00		19 00			19 00	
E. ...	49	8 5 12 0 5 10 5 0 3	8 8 12 0 12 6 5 0 1	8 8 5 10 1 8 5 0 1			8 5 12 0 6	37¾	38	.413	15 69		15 69	35		15 69	
Wil...	50	8 7 12 9 12 5 5 0 6	8 5 12 3 1 3 5 0 2	8 9 4 12 0 12 5 5 0 4			8 5 12 0 3	37½	38	.388	14 74		14 74			14 74	
TOTAL								1867	1898		861 46	19 65	888 11	730	15 50	858 31	

CHECKED BY EMPLOYES AND RATES ...D

EXTENSIONS RSB

AUDIT J.F.R.

PAGE No. 107

Automatic Payroll Machine records provide ample space for all the necessary computations and extensions. Column headings and the arrangement of columns depend upon the user's needs—all records, therefore, are furnished according to individual specifications.

Employe names are inserted before the record sheet is placed in the Payroll Machine. Spacing has been arranged so that this may be done either by typewriter (using long carriage) or by addressograph.

Registrations are compact, yet easily read. Two-color printing speeds up computation and hence cuts down the payroll preparation time. All blue records indicate full time. Deductions and overtime allowances are made only where the records appear in red.

The Automatic Payroll Machine Record is designed to be used as an original payroll ledger sheet. All computations and extensions are supported by their original time records, convenient for auditing and always available for insurance, income tax or other legal purposes.

The employer of labor should buy a Dial Recorder because the record produced by the machine gives him better administrative control over his payroll expenditures.

The elimination of transcriptions by having figures of both original and final entry all on the payroll sheet and the cleanliness, compactness and protection from tampering afforded by a record kept under lock and key, make the International Dial Recorder the most complete, efficient, and highly desirable Payroll Recorder ever manufactured.

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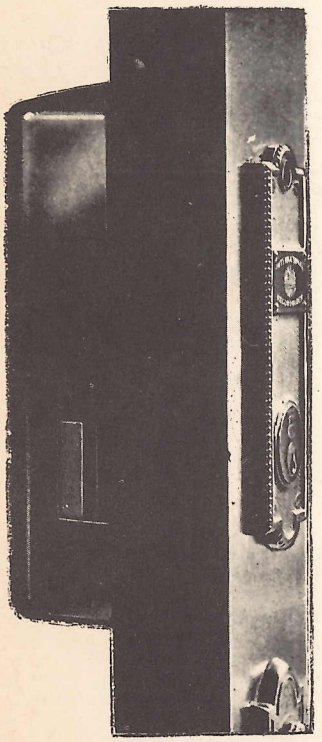
4. International Recordolock



The International Recordolock is a recording door lock which gives complete protection and positive supervision for important doors.

It stands in a class by itself because its record of the activities it supervises is complete, compact, easily read, and immediately available to the person authorized to have access to it.

The Recordolock is absolutely the only device of its kind on the market which furnishes:--

First: -- A straight line printed record in days, hours, and minutes of the locking and unlocking of a door.

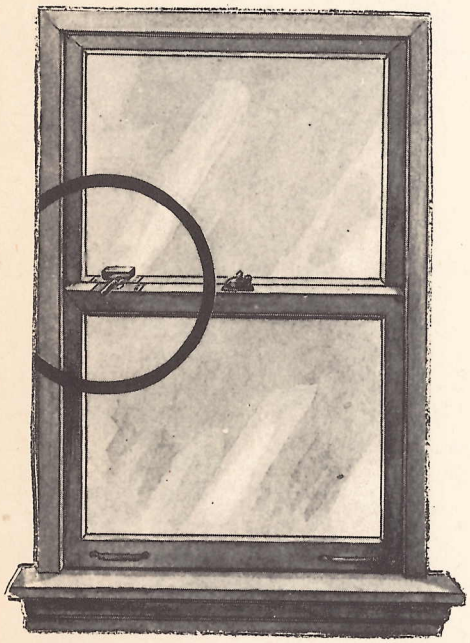
Second: -- A record of locking and unlocking from the inside, thus fixing responsibility for night visits.

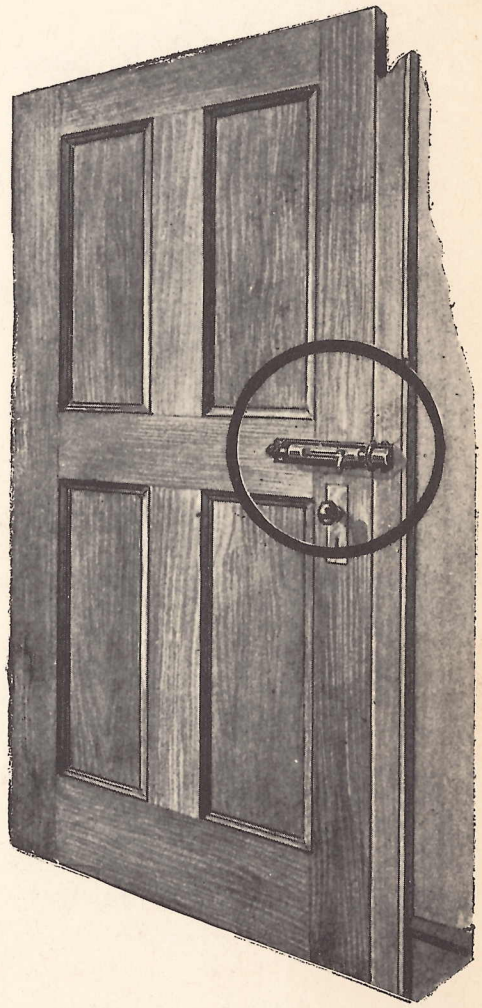
Third: -- Automatic control from one point over the securing of all entrances.

Fourth: -- A watchman's registration to prove whether or not watchman service is being rendered according to schedule.

The Recordolock system is composed of three operating units: -- the lock, the control box, and interlocking bolts, and the wiring and accessories necessary to connect the three units into an operating system.

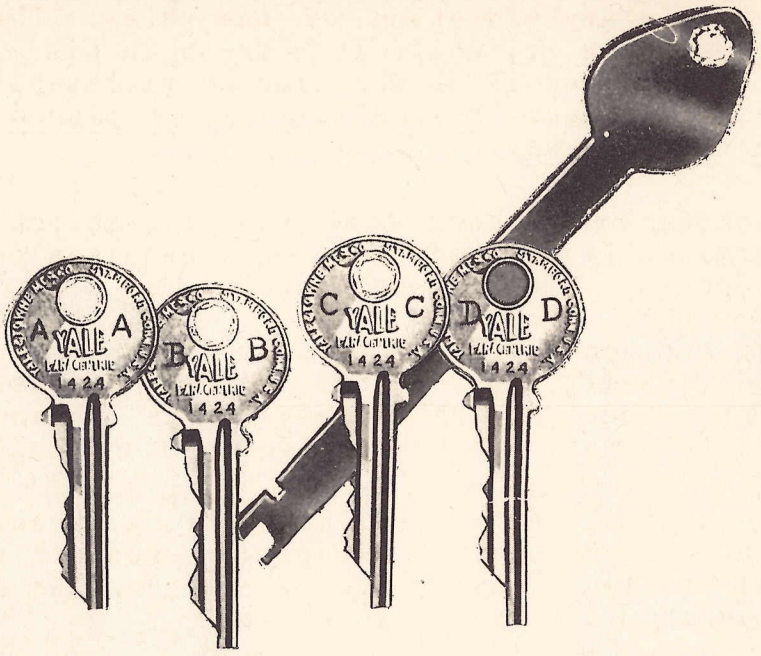
The Recordolock furnishes on one straight line an accurate printed record of the day, hour and minute that it is operated; the letter of the key with which the operation was performed, and what the operation was (whether locking or unlocking from the inside or outside or a watchman's registration).

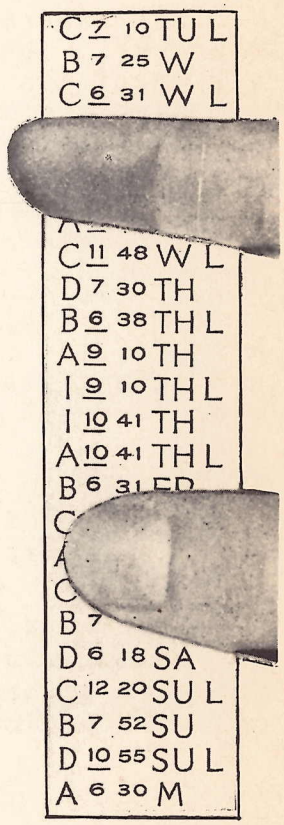




An additional exclusive feature is the interlocking of bolts on doors or windows. When bolts are left open, the key cannot be turned in the Recordolock. This prevents the possibility of leaving back doors or other entrances unlocked during "closed hours."

The Control Box houses the means for supplying current of the proper voltage for operating the Recordolock system from the electric light service mains.





Four keys designated by the letters A, B, C, and D, operate the Recordolock only from the outside. The letter I signifies that the lock was operated from the inside by the "inside key."

The letter W in the key record column identifies a watchman's record.

The time is always printed in figures. P.M. time is denoted by a line under the hour figure.

The day of the week is plainly abbreviated: -- M for Monday, TU for Tuesday, etc.

The letter L in the last column definitely denotes that the door was locked.

If no letter appears, the operation was always unlocking.

The record, as shown by the facsimile can be read easily and accurately.

In a record of a few lines is packed a complete story for the supervisor of a place of business. By merely unlocking the case of the lock and reading the record, he can learn at a glance just what happened and handle any violation of the rules. The man who made the record must explain it, while it is fresh in his mind. The time to discipline an employee is at the time he violates the rules, not a week or ten days later. Responsibility is placed squarely upon the man who carries the key.

Past experiences have shown that the Recordolock can be used wherever a permanently located container requires recorded supervision of its opening, closing, or protection.

Places where the Recordolock has proved its worth are: -- chain stores and individually owned stores, banks, offices, warehouses, stockrooms, etc. Some of the largest retail chain stores have standardized on International Recordolock protection.

A man should buy an International Recordolock because it protects his profits and his property by supplying recorded supervision of the opening and closing of his place of business and of the protection given it during the time it is closed.

It is the only lock that furnishes complete door protection. Police records show a majority of store robberies are the result of unlocked doors or windows.

The Recordolock may be purchased on a deferred payment plan which enables the user of a rental lock to purchase outright all the superior advantages of a Recordolock without losing the convenience of small periodic payments.

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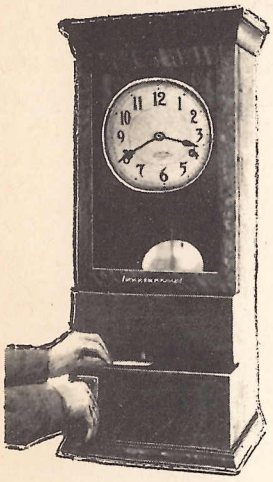
5. International Cost Recorder

A Cost Recorder or Job Time Recorder is a special purpose time stamp used to record the starting and stopping time of jobs on a suitable form. This time record is used to compute costs of different operations.

The machine derives its name from the purpose for which it was originally developed -- recording job time in manufacturing plants to furnish accurate original records for the proper distribution of manufacturing costs.

International Job Recorders are manufactured in a variety of models to meet the various needs and conditions of industry.



The wood case Job Recorder is operated by a self-contained, eight-day, key-wound, pendulum-driven clock.

Series 700 and series 750 are provided with three type wheels -- and print the day of the week or month, hours and minutes, tenths or hundredths of an hour. A symbol line is provided under the hour to distinguish P.M. records. A month wheel can be provided at a small extra charge.

Series 2000 and series 2600, in addition to providing the regular three type wheels, as on the 700 series, can be provided with month and year wheels. A symbol wheel to identify the recorder used can be furnished in place of either the month or year wheel.

These recorders can also be furnished to print time in consecutive periods of one-tenth hour each.

Where it is required, an A.M.--P.M. wheel can be furnished.

The metal case Job Recorder is manufactured in three types: --

1. Minute impulse driven from master clock system.

2. Synchronous motor-driven (self-contained).

3. Key wound, marine escapement mechanism (self-contained).

The series 2000 and series 2600 Job Recorders may be equipped with a notching device which facilitates correct spacing of the card. Each time a registration is made, a notch is clipped from the card. When the card is placed against the positioning bar or stop for the next registration, the cut-out brings the card up to the line.

Where job time is recorded and jobs extend over the noon period, or are started in the morning and are finished some time in the afternoon, it is necessary to eliminate the noon hour from the elapsed time total of such a job.

In using a standard International Job Recorder, it is necessary either to provide for the stop and the start time being recorded at

noon, or when compiling the total time, to subtract the noon hour period from the total of the elapsed time.

To overcome this and automatically eliminate the noon period, or supper hour period, an elapsed time control program cabinet is available for master clock operated job time systems. This cabinet automatically starts the Job Recorder type wheels at the beginning of the day and automatically stops them during the lunch period and starts them again at the starting time of the afternoon schedule. The elapsed time program can be set up to meet practically any working schedule.

Certain industries run many jobs on a continuous basis from day to day and do not close until they are finished. In these cases a job may be started one day and run to the end of the week, or for one, two or three days. For this purpose our 2900 series of job recorders are used. The recorders print from 0 to 239 periods of one-tenth of an hour each for a daily cycle of 24 hours, or from 0 to 599 periods for a weekly working period of 60 hours. With these machines the elimination program suspends impulses during lunch time and after hours, starting the impulses again at the beginning of the next starting time.

A new adaptation of the period recording principle has been worked out recently (1934) for use in industries where the Bedeaux wage payment and incentive plan is in effect. This system is based upon the Bedeaux "Point," which is the standard measure of the amount of productive work which may be done by the average worker, operating at normal speed, within one minute of time. Each operator, as he receives the job, is given the point standard allowed for the operation and upon its completion is given credit in accordance with the standard for the number of prices produced without regard to the time required to perform the work. To analyze his efficiency by jobs and to assess indirect costs or overhead, a record of time expended on each job is essential.

Many users of the Bedeaux plan employ job time recorders to secure such records. The new Bedeaux Recorder has been designed to give these time records in a form that will work in directly with the Bedeaux plans of labor accounting. The type wheels of the machine are set to handle from 0 to 1199 minutes or equivalent to a 20 hour day. This direct recording in minutes provides an accurate and simple method to obtain subtractions of the number of minutes spent on a job.

Where self-contained Job Recorders are used, time elimination is limited. The most practical way to eliminate time on these recorders is to engrave the hour type wheel for two consecutive hours exactly the same.

The operation of the Job Recorder is extremely simple. To make a registration, the card is inserted in the slot all the way back. The line on which the record is to be printed is aligned with the position indicator and the registering lever is pressed down as far as it will go.

The Job Recorder furnishes a straight line, commercially accurate printed record.

Registrations can be made along any edge of a card and the margin between the edge of the card and the registration may be any width from 1/8" minimum to 11/16" maximum.

The registration may also be made to appear at the right or left side of the form and recorders are identified as right or left hand print to designate the side of the form on which the registration is to be made.

The spacing between the Job Recorder registrations should never be closer than one-quarter of an inch.

One may reasonably say that there are but few industries and places of business where Cost Recorders cannot be used.

International Cost Recorders should be used wherever a business is buying and re-selling time as a part of the value of produced goods or a service rendered.

A man should buy an International Cost Recorder because ACCURATE COST RECORDS ARE NECESSARY TO PROTECT PROFITS.

The Job Recorder insures that total time is properly divided and charged against the jobs where it was applied -- and the recording of time must be done at the time the work is produced.

International Job Recorders are also used as attendance recorders in garages, small shops, and stores. They are extensively used to register the arrival and departure of buses, trains, and trucks.

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Form No. S13190
DEPT. 14

DAY WORKER'S TIME CARD DATE 3/29

JOB NO. | NAME J. Morse | CHECK NO.
NO. WANTED | TYPE, CLASS, DESCRIPTION OF PART Roller Bearings | SHOP ORDER 9643
DRAWING PATTERN SPEC. OR CAT. | | DETAIL OR PART NO. 12
OPERATION Cutting | | NO. COMPLETED 2160 | ESTIMATED HOURS

			ACTL HOURS	PREMIUM HOURS	TOTAL HOURS	AMOUNT
MAR 29	9 .5	STOP				864
MAR 29	8 .0	START	1½		1½	

APPROVED E.S. Allen FOREMAN

No. 43
Form No. S13100

PRODUCTION COST CARD

NAME E. Stimson DEPT. 12
ORDER NO 2142 MACHINE NO. 23
PART NAME Connecting Rod
OPER. NAME Milling Sides PART NO 31
OPER. NO 16

PIECES	P. W RATE	AMOUNT		RATE	ELAPSED TIME	
100		2.94	Finish			MAR 1 11.2
			Start	.70	4.2	MAR 1 7.0

O. K. L. Madison FOREMAN

DEPT NO	EMPLOYEE NO	EMPLOYEE NAME	DATE
3	143	Robert Armstrong	Apr 5, 1930

ORDER NO	PART NO
1698	1786

OPERATION NO	MACHINE NO
12	16

NAME OF OPERATION: Grinding

PIECES FINISHED	HOURS
15	7.5

HOURLY RATE	PIECE RATE
65	

AMOUNT 1.63

YR	MO	DAY	DEPT NO.	EMPLOYEE NO	ORDER NO	PART NO	OPER NO	MAC NO	PIECES FINISHED	HOURS	AMOUNT
	10										
	11										
	12										
	31	1	1	1	1	1	1	1	1	1	1
	32	2	2	2	2	2	2	2	2	2	2
	33	3	3	3	3	3	3	3	3	3	3
	34	4	4	4	4	4	4	4		APR. 5	7.0
	35	5	5	5	5	5	5	5		APR. 5	4.5
	36	6	6	6	6	6	6	6			
	37	7	7	7	7	7	7	7			
	38	8	8	8	8	8	8	8			
	29	9	9	9	9	9	9	9			

PRODUCTIVE DAY WORK

Detail No. 2142 Lot No. 587 Date
Article Upper Bracket No. of Pieces in lot 100.
Name Edward Spencer
Mach. No. 425
Operation Milling Sides for Connecting Rod
Quantity Finished 100
Deduct Spoiled 2
Deduct Defective 1
Foreman H. Norton

Stop MAR 1 11.2
Start MAR 1 7.0
Time 4.2
Rate .70
Amt. 2.94

Employee's No.

ORDER NO. 1236 FOR N.S. Jacobs DUE 5/28/30
NAMED
I.T.R. No. S15413

QUANTITY 5M SIZE 14x22 PAPER Bond
Press of I. T. R. Co. of N. Y.
Printed & folded as per sample attached

WORKMAN 38 MACH. No. 17

				HOUR RATE	AMOUNT	TOTAL
1930 MAY 27	7.0		STOP	.90	1.71	3.14
1930 MAY 27	5.1	19	START	MACH. RATE .75	1.43	

SCHEDULE

MAKE A NOTE OF ANYTHING WHICH HAS SLOWED YOU UP Grease spots in stock.

FORM T 1

Various commonly used forms of individual job tickets

DAILY COST CARD

No. 27 DATE 8/23/30

I. T. R. Co. Form No. 6977

NAME Joe Ralston

Job No.		Time	Clock Time Record	
	OFF			
	ON			
	OFF			
	ON			
	OFF			
	ON			
	OFF			
	ON			
	OFF			
	ON			
	OFF			
	ON			
	OFF			
	ON			
1737	OFF	.5	AUG 23	9.0
	ON		AUG 23	8.5
1701	OFF	1.2	AUG 23	8.5
	ON		AUG 23	7.3
1693	OFF	2.5	AUG 23	7.3
	ON		AUG 23	4.8
1680	OFF	1.6	AUG 23	4.8
	ON		AUG 23	3.2
1673	OFF	3.2	AUG 23	3.2
	ON		AUG 23	0.0

PRESS OF INTERNATIONAL TIME RECORDING CO. OF NEW YORK

(a)

Form No. S13097 DAILY COST CARD

NAME Jos. Prentice DATE 3/27

TIME RECORD			Elapsed Time	Rate	Cost	Quantity	Order No	Operation
MAR 27	5 00	F	1.36	.56	.90	75	2124	Polishing
MAR 27	3 24	S						
MAR 27	3 24	F	2.14	.56	1.25	110	3206	Bevel sides
MAR 27	1 10	S						
MAR 27	12 10	F	3.05	.56	1.72	249	1816	Groove
MAR 27	9 05	S						
MAR 27	9 05	F	1.05	.56	.61	69	986	Face ends
MAR 27	8 00	S						

TOTAL HOURS 8 RATE .56 COST 4.48

(b)

		Elapsed Time	Dept No 18	Emp No 2-348	Employee's Name Albert Bond
FEB 18	5 .0	4.0	Part No 17-483	Drawing No 8945B	
FEB 18	1 .0				
FEB 18	11 .4	2.9	Mach No 238	Order No 248-392	
FEB 18	8 .5				
FEB 17	11 .7	4.7	Description Machine O.D. Spanner Forgings		
FEB 17	7 .0				
FEB 16	5 .0	1.5			
FEB 16	3 .5				
FEB 16	9 .9	2.9			
FEB 16	7 .0		Foreman S.O.K. S B Ross		
FEB 15	5 .0	9.2	Total Time 25.0	Rate .55	Amount 13.75
FEB 15	7 .0				

Order No | Emp. No. | Hours | Amount | Dept

(c)

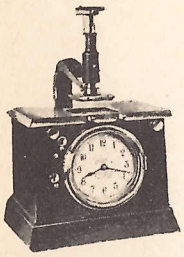
Various forms of continuous job tickets. Forms "a" and "b" illustrate distribution by part number. Form "c" shows the record of a job carried over several days.

6. International Time Stamps

The Time Stamp is exactly what its name implies: -- a machine to stamp the time that letters, telegrams, messages, orders, invoices, documents, etc., are received or dispatched.

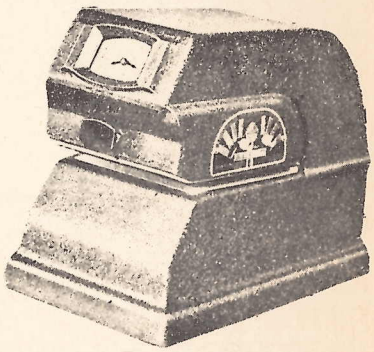
International Time Stamps are in use in offices, factories, schools, institutions, retail and wholesale establishments, local and national administrative departments, banks, hotels, etc., which indicates partially the wide-spread field of application for this product. International Time Stamps leave no chance for neglect in handling important papers.

The International Model A Time Stamp (Series 7000).

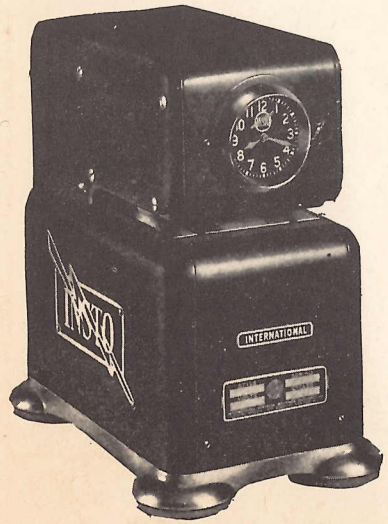


The Model A prints on the under side of the sheet and is known as a bottom print stamp. The record is made by hand pressure and presents a straight line record of month, date, time, and year, as MAR 1 2 00 PM 1934 It is equipped with the exclusive International fully automatic type wheels which eliminate all manual setting except moving the year wheel ahead one position on January first.

The International Electroprint Time Stamp (Series 7300).



The Electroprint Stamp is a top printer -- stamping its record on the upper side of a letter or document. The printing is done electrically and controlled by a button on the front of the stamp. The type wheel assembly and the record printed are the same as the Model A. This stamp can be furnished for synchronous motor, or minute impulse drive, but not for spring drive.



The International Insto Time Stamp (Series 7400).

The International Insto is a top print, electrically operated stamp, giving a straight line print of year, month, date, and time, as follows: 1934 MAY-17-PM 4:14. Certain models may be furnished to print tenths of minutes in addition to the standard date and time record. Also numbering devices may be attached to indicate order of receipt. The

record is made automatically when a sheet of paper is inserted in the throat of the machine.

Printed below are illustrations of characters printed from special plates and cylinders, etc., which may be furnished on all International Time Stamps.

FACSIMILE OF PRINTING

PAYROLL BUREAU	(Upper Cylinder) Any three words Instantly interchangeable
NEW YORK EDISON CO.	Upper Name Plate Name
MAR 30 7 59 AM 1930	Date Line
EMPLOYEE'S ASSOC DIV. 4 IRVING PLACE	Lower Name Plate Address
RECEIVED	(Lower Cylinder) Any three words Instantly interchangeable

The printing or type wheels are continually locked, preventing tampering or shifting to obtain other than the accurate time and date.

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7. International Electric Hourly Supervised Time Systems

Up to this time, we have dealt with only those of the I.T.R. products which are particularly adapted to operation as individual units.

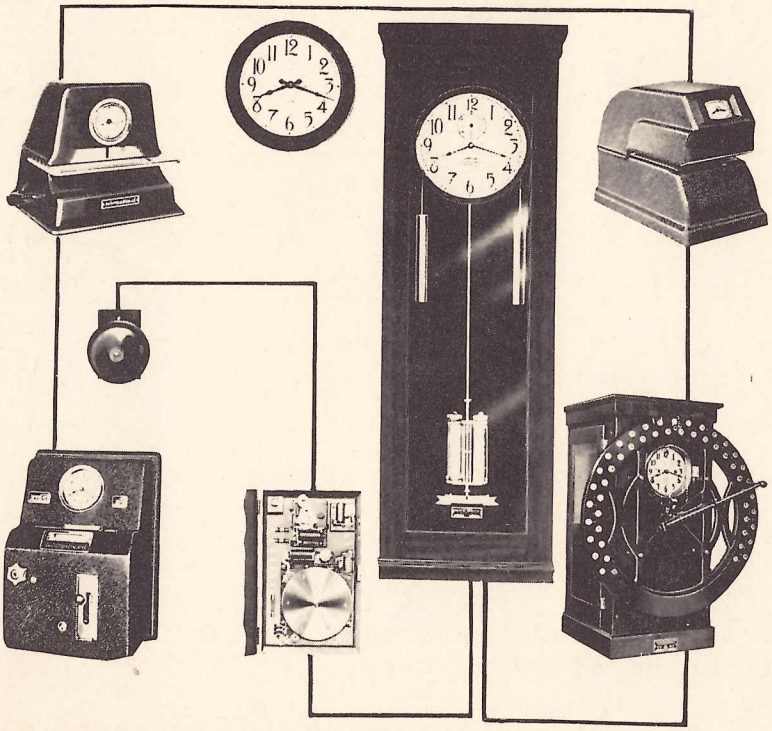
Where a number of independent spring-driven recording and indicating units are used in one establishment or building, it is almost impossible to keep them in step with one another. To keep the various individual units checked up requires a man constantly to check and set them in an attempt to obtain uniform time. To overcome this trouble, various types of electric clock systems were developed over a period of many years.

One of the first considerations was a source of electrical current to operate the clock systems. A battery was used to furnish the power because the power supply available in the early days was not constant, and in some cases the commercial supply was turned off over the week-ends. An arrangement for charging the battery was necessary and the need for someone to watch the charging rate and keep the battery filled with distilled water meant constant manual supervision. This manual supervision was not the satisfactory ar-

rangement it would appear to be and in many industrial plants, schools, and public buildings where no electrician was in charge of the electrical apparatus, it was very difficult to obtain and keep someone on the job to make sure a constant supply of current was available for the electric clock system. When the clock system current supply began to fail, it caused a scattering of the various secondary units and this meant a step-ladder job of setting all the units alike after the power supply had been put back in shape to operate the system.

The next step was an attempt to operate from the direct current supply where it was claimed to be constant, and this was found to scatter the system units at various time due to the blowing of main fuses in a building, electrical storms interrupting the power supply, and temporary drops in voltage, etc.

The difficulties thus encountered over a period of years lead to the final achievement by the International Time Recording Company, in 1924, of the International Self Regulating Electric Clock System.



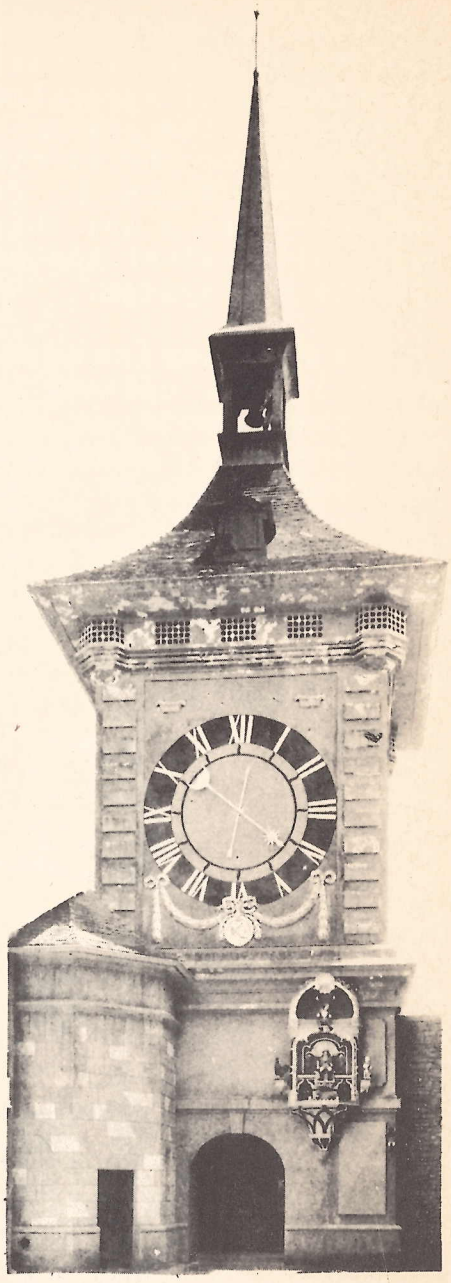
This wonderful development corrects any variation in agreement with the master clock time, and provides that each subsidiary unit, such as secondary clocks, recording units, and program devices automatically compares its time with the master clock every hour separately and independently of the others. Variations up to fifteen minutes in any given hour and forty-five minutes over a three-hour

period are taken care of automatically.

In addition to the recording units and program devices furnished to operate on an International Hourly Supervised Time System, a complete line of secondary clocks are available, from plain round or square wall types to rich cases with elaborate bronze, silver, glass and skeleton dial faces. Various brackets and suspension chains are available for use with these secondary clocks. Many types of tower clocks are available with the International Hourly Supervised features.

Years of service throughout the world, in industry, schools, hotels, public buildings, railway terminals and in many other locations, too numerous to mention, have proved the dependability of International Hourly Supervised Electric Time System.

-o-



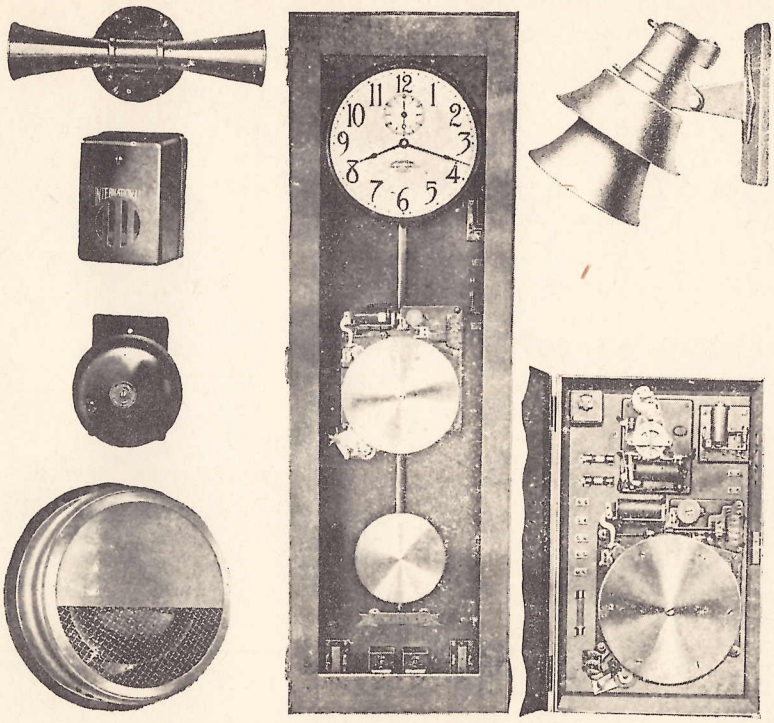
8. International Program Systems

An International Program Machine automatically sounds the exact time for starting and stopping work throughout business establishments, and for the moving of classes in schools.

The Program Machine actuates electric bells, horns, sirens or whistles. The flexibility of the International Program Machine is such that it can be made to handle any number of different schedules on different days and also automatically to cut out regular programs over the week-end or any certain day.

The Program Machine may be mounted either in a master clock case or in a separate cabinet. The schedule of signals is set up on a program drum by means of easily adjusted pins or lugs. A calendar device silences all signals during the night, week-ends, or any other desired period. Any combination of schedules can be set up with the International Program signal system.

Special Program Machines are furnished to control chime broadcasting equipment used for tower clock installations. The Interna-



tional Program Machine is also used to control automatically the start and stop of machines in process work, in conjunction with a self regulating time control system.

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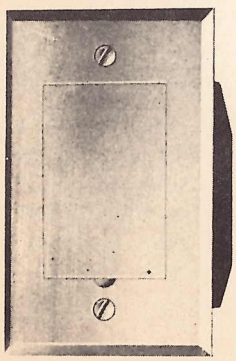
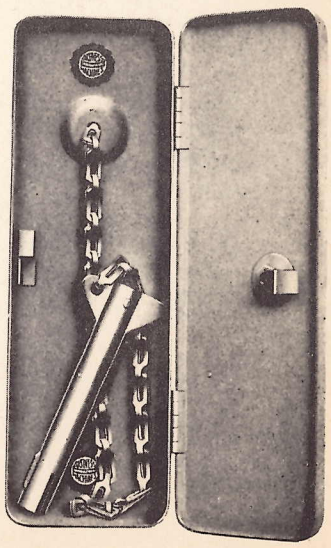
9. International Watchclock



The International Watchclock is a portable, eight-day, key-wound time recorder that is operated only with special self-identifying keys. The keys are permanently attached by a chain to boxes or key stations at predetermined locations.

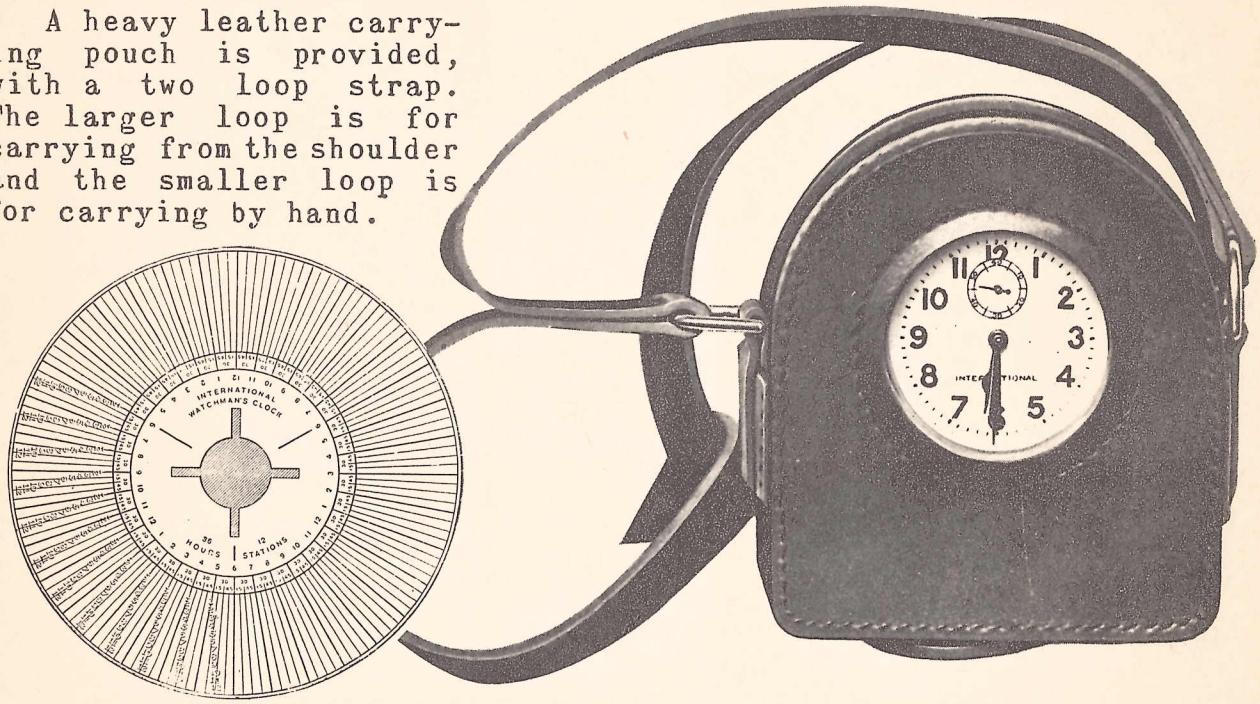
Registering stations are furnished in either surface or flush mounting types. There is a nu-

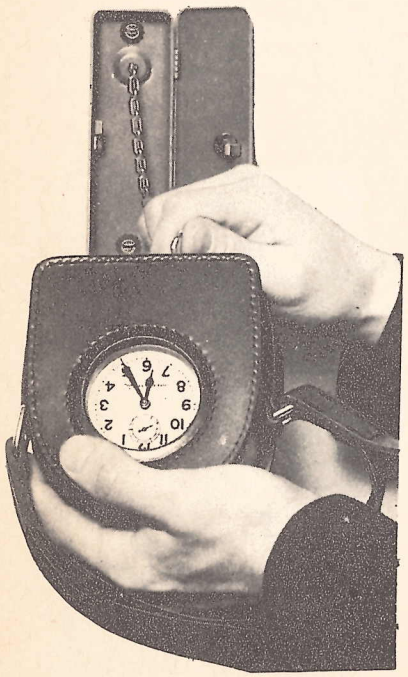


meral on each key to correspond with the station number.

The Watchclock and the key stations comprise a watchman's time system.

A heavy leather carrying pouch is provided, with a two loop strap. The larger loop is for carrying from the shoulder and the smaller loop is for carrying by hand.





The clock case of heavy die-cast metal with a hinged door completely protects the movement against heavy usage and exposure to dirt and moisture.

The leather cover slips over the case and is securely closed by a strap and buckle. The buckle is provided with lock and key doubly to secure the record within. Shatterproof glass protects the clock face from injury and assures clear unobscured vision.

The Watchclock record is a paper disc printed in one-quarter hour graduations covering a period of thirty-six hours. The turning of a station key in the clock embosses the key number on the paper disc. The key record is automatically placed in the correct field on the disc when the watchman turns the key in the clock.

The Watchclock provides an accurate, indis-

putable record of the time each key station is visited. The record provides the means of supervising the watchman by recording the promptness with which he makes his rounds according to a fixed schedule. When the key stations are properly located, every part of a building or plant will be visited regularly by a person whose duty it is to see that everything is in order.

The Watchclock should be used wherever the hazard from fire, water, or robbery requires the protection of a watchman.

A man should buy a Watchclock because: --

1. It gives him indisputable evidence that his property is receiving the protection he is paying for.

2. By watching his watchman, it gives him double protection against shutdowns caused by fire, thus insuring his income and protecting him against loss of customers during rebuilding or repairs from such a cause.

3. It gives him a reduction in insurance rates -- saves money. The International Watchclock is approved by the National Board of Fire Underwriters Laboratories.

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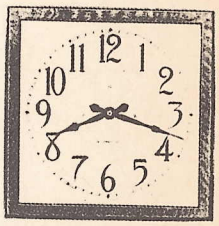
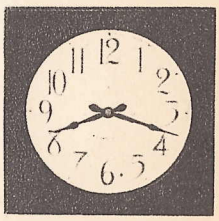


List No. 10-45

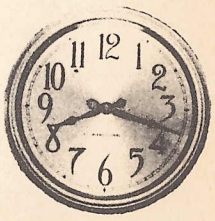
10. International Unit Clock

The Unit Clock is the simplest product in the I.T.R. line. It is a self-contained time indicating unit manufactured with the same careful attention and regard for quality that is given to all I.T.R. equipment.



List No. 11-55

The various styles and types available are illustrated at the right. They are available in square wood cases finished in either mahogany or dark oak, or round metal cases finished in satin aluminum, polished aluminum, or dark green morocco finish.



List No. 14-45

The clock movement has been eliminated and a small compact synchronous motor drives the hands. This motor operates in synchronism with the oscillations of the alternating electric current. The electric current supply must be constant. Supervised 60-cycle alternating current is, commonly supplied in practically all communities today.

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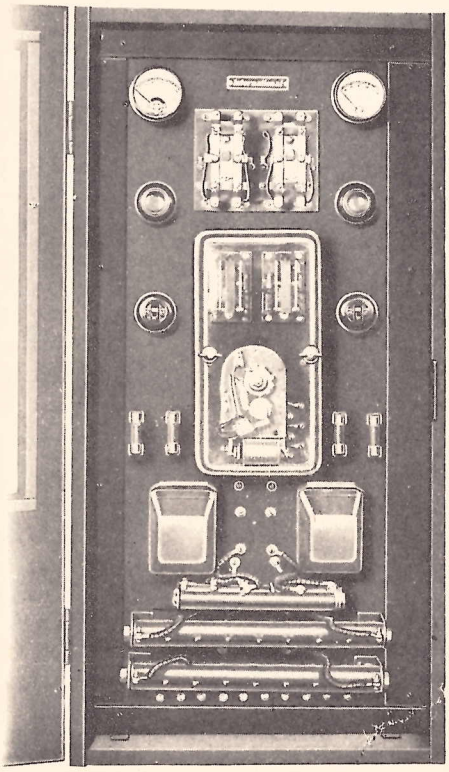
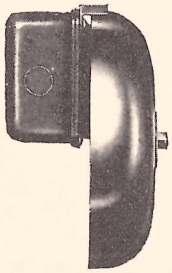
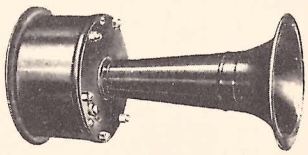
11. International Fire Alarm Systems

International Fire Alarm Systems form a complete line suitable for every industrial and institutional use.

The Fire Alarm System is an electro-mechanical means of providing protection to lives and property from injury by fire.







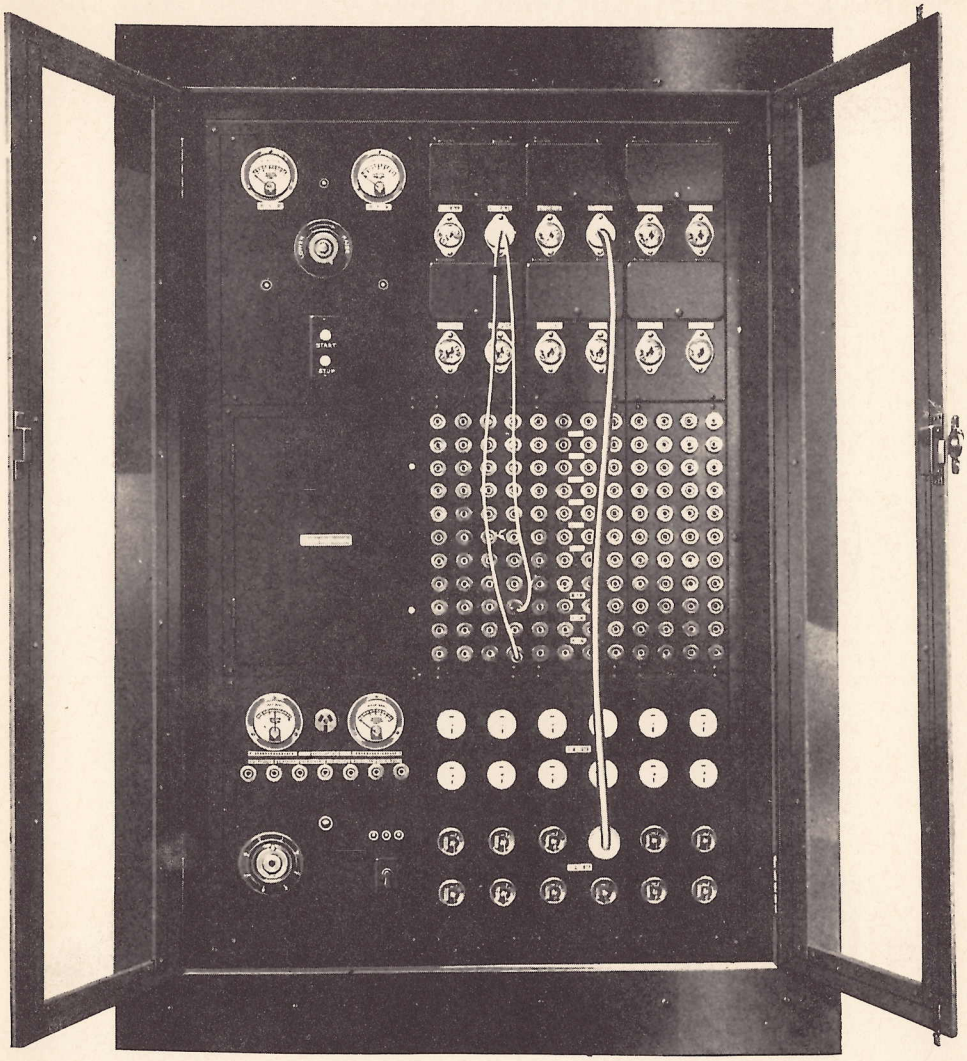
It gives notice of the existence of a fire by means of pre-arranged signals actuated by the simple act of breaking a small sheet of glass, or pulling a lever at a Fire Alarm Station, thereby warning all occupants of a building to evacuate it.

All the latest engineering features are incorporated in International Fire Alarm Systems. They are sold and installed under the approval of the National Board of Fire Underwriters Laboratories.

12. International Laboratory Experimental Voltage Distribution System

The International Laboratory Experimental Panel is manufactured

for use in science laboratories of schools, colleges and industrial organizations.



It provides a means of supplying any number of different voltages in either alternating or direct current to tables or benches used for experimental purposes. With the use of an International Laboratory Experimental Voltage Distribution System, a supervisor can easily and quickly furnish the proper current supply for an experiment, and thus safeguard against the accidents which occur where poor methods make it easy to supply the improper voltages.

Unit type of construction provides flexibility and facility to meet practically all specifications; and also provides for future additional sections.

13. International Interior Telephones

International Telephone Systems are designed for interior communication. They provide inter-office, room, or department communication without interfering with outside telephone systems.

Telephone systems are divided into two classes, known as common talking and selective talking.

Common talking means that all conversations are carried on over two common wires and that only one conversation can be held at one time. Any number of phones may listen in on this conversation.

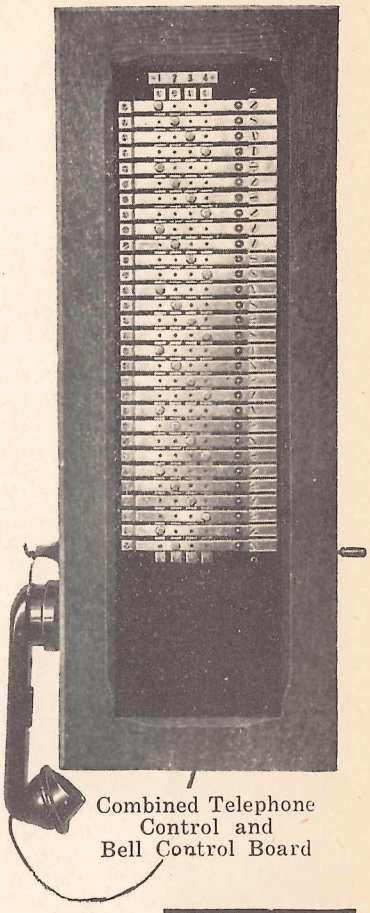
Selective talking means that there is an individual circuit for each telephone and that the conversations are private.

International Telephone Systems are available in various types from the simplest, which comprises a master telephone and push

button board connected to outlying telephones, to elaborate systems comprising switchboards or private exchanges.

Their chief applications are in schools, homes, institutions, industrial plants, and business organizations for intercommunication independent of outside telephone service.

The International Combined Telephone and Program System is particularly adapted to small schools. Economy in equipment and installation is effected by using the program signalling equipment and wiring for telephone signals. The push buttons on the room bars of the bell control board serve also as signal buttons for the telephone system.



Combined Telephone Control and Bell Control Board

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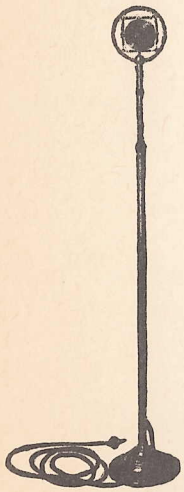
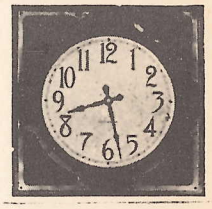
14. International Central Control Radio, Music and Speech Systems



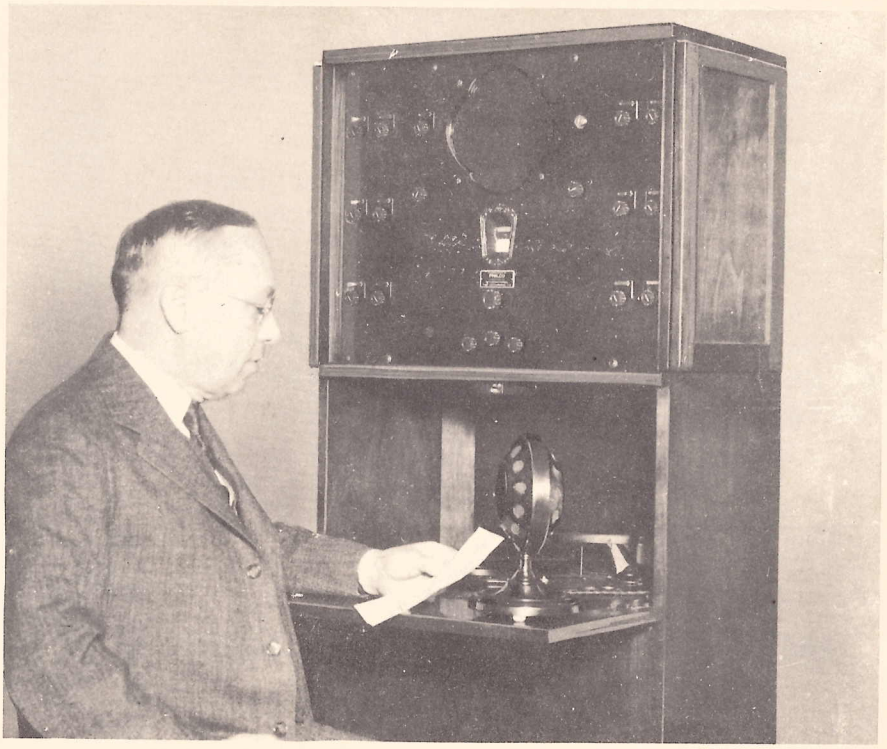
International Central Control Radio equipment is designed and built so as to secure proper coverage of rooms and auditoriums, or assemblages with undistorted reproduction of original programs.



The basic reason for International quality and performance is that sets are designed and built as complete musical instruments with every component part and unit from antenna to speaker perfectly matched with every other part.

Return speech is a very important development of International systems which enables one to speak from the control panel to any room where a sound reproducer is installed and also permits the one at the control panel to hear everything within the room to which he is speaking. The return speech feature enables a supervisor to sit at the control panel without leaving his office and listen in on classes and study the instructors' work and the reaction of the classes without their being aware that he is listen-

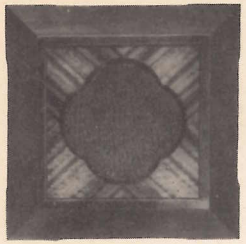
ing in. This gives a supervision which reaches far beyond anything available in the past. The use of the return speech feature in in-



dustry enables an executive to speak to anyone in a department and the one spoken to need only reply, not having to leave his work as he would to answer a telephone.

The International SCHOOLMASTER

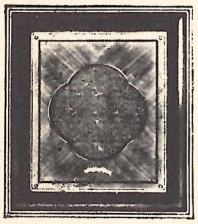
2 WAY
SOUND



INTER-ROOM
TELEPHONE

and **PROGRAM SIGNAL SYSTEM**

International Central Control Radio, Music and Speech equipment can be used in amusement parks and recreation centers, arenas, concessions, stadiums, auditoriums, convention halls, schools, colleges, churches, mortuary parlors, railway and bus terminals, cemeteries (chapels and carillons), restaurants, hotels, clubs, etc.



The performance of Central Control Radio, Music and Speech equipment can be summed up under three general heads: --

1. Receiving, amplifying and distributing broadcast radio programs.

2. Amplifying and distributing the human voice and instrumental music from a microphone.

3. Amplifying and distributing electrical transcriptions of sound reproductions from phonograph records.

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The latest addition to this line is the International Schoolmaster. This is a two-way sound distribution system, to which an International inter-room telephone system and an automatic program signalling system have been added.

This entire system has been so simplified that a small special cable does the work of nine wires ordinarily required. The elimination of excess wiring and accessory devices reduces installation and maintenance costs to a minimum.

This new educational device may be used in the following ways:

1. Personal addresses or special announcements by the principal to one or more classrooms simultaneously.

2. Personal observation of classroom activities.

3. Two-way conversations with instructors either privately by telephone or over the sound reproducers for the benefit of pupils.

4. Reproduction of phonograph recordings, for one or more rooms simultaneously.

5. Reproduction of radio broadcasts, for one or more rooms simultaneously.

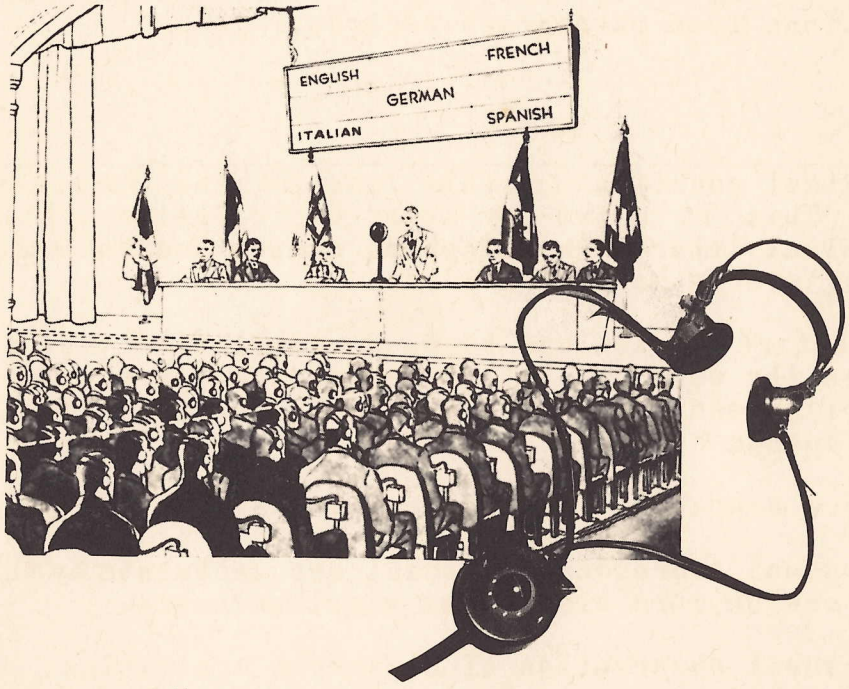
6. Automatic operation of classroom assembly and dismissal signals.

Here is one of the most effective educational tools ever devised--a three-in-one supervising system, in which all essential school operating routines are centralized for more economical executive supervision.

14. International Filene-Finlay Translator System

No longer are conferences between men of many lands doomed to be dreary, long drawn-out affairs, where a succession of interpreters repeat every original speech made.

The International Filene-Finlay Translator System permits such conferences to proceed with as much ease as a gathering where everyone speaks the same language.



The speaker has a microphone placed before him which picks up his talk and sends it to sound-proof rooms in which interpreters sit with head-sets on, listening in. Each interpreter translates the speech as it is being delivered and presents it through his microphone in the language which has been assigned to him. Provision is made in this manner for the simultaneous translation of a speech into four languages other than that used by the speaker. These translations are transmitted to control switches and head-sets provided at each seat in the audience.

Anyone in the audience who does not understand the language being used by the speaker, uses a head-set and sets the selector switch at the language he can understand.

This equipment is designed for installation either in temporary or permanent form.

Additional microphones may be placed to permit floor discussions.

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BUSINESS
INTERNATIONAL
MACHINES